BULLETIN of the
SCHOOL OF EDUCATION
INDIANA UNIVERSITY

Indiana and Midwest School Building Planning Conference: Proceedings

Vol. XXVII, No. 6 November, 1951

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BULLETIN OF THE SCHOOL OF EDUCATION
INDIANA UNIVERSITY

Indiana and Midwest School Building Planning Conference: Proceedings

Published by the
DIVISION OF RESEARCH AND FIELD SERVICES
Indiana University

Price, $1.00, postpaid

For sale by the Indiana University Bookstore

Bloomington, Indiana

Entered as second-class mail matter September 30, 1924, at the post office at Bloomington, Indiana, under the Act of August 24, 1912. Published in January, March, May, July, September, and November of each year, from the University Office, Bloomington, Indiana.

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Foreword

Again we come to the pleasurable task of compiling the voluminous materials for the *Proceedings* of the 1951 Indiana and Midwest School Building Planning Conference. Space has limited us to the publication of the highlights only. The big criticism we have received of this conference is that we had too much going on at the same time. Haunted by the fact that the United States is now facing the greatest school building program in history, we no doubt attempted to explore too many areas in one conference period. We hope that this bulletin will serve as your proxy at those meetings which you were unable to attend.

The many specialists invited to participate on the program were selected because of their great contributions to the field of school building planning. For the most part, their only reward for assisting at this conference is the knowledge that, because of their efforts, the boys and girls of tomorrow are likely to have better educational environment. Although this does not buy food and purchase lodging for the speakers, I do believe it will influence, more than we realize, the future of American civilization. So, to you participants we say, "Thank you for everything," and to you readers, "We hope you will find much practical material in this bulletin."

PAUL W. SEAGERS,
Chairman

Program

1951

Indiana and Midwest School

Building Planning Conference

A conference designed to interest teachers, principals, superintendents, board members, trustees, architects, parents, and citizens' advisory groups.

PAUL W. SEAGERS, *Conference Chairman*
WENDELL W. WRIGHT, *Dean, School of Education*

SCHOOL OF EDUCATION INDIANA UNIVERSITY

BLOOMINGTON, INDIANA

WEDNESDAY AND THURSDAY
JULY 11-12, 1951

1851 An Educational Centennial 1951
July 9-14, 1951
One Hundred Years of Teacher Education

PROGRAM

WEDNESDAY MORNING, JULY 11

School of Education—University School

9:00 a.m.* Registration—Lobby, University School

10:00 a.m. General Session—Auditorium, University School

Chairman—H. L. Smith, Dean Emeritus, School of Education, Indiana University, and Director of School Building Planning, Indiana State Department of Public Instruction

"Some Relationships Between the University and the Public Schools" —Wendell W. Wright, Dean, School of Education, Indiana University

"Leadership in Cooperative Planning"—Paul R. Mort, Professor of Education, and Director, Metropolitan School Study Council, Teachers College, Columbia University

"The Power of the Public"—Paul W. Seagers, School Building Consultant and Associate Professor of Education, Indiana University

WEDNESDAY AFTERNOON, JULY 11

1:30 p.m. Discussion Groups

I. The School Library, University School, Room 210
Chairman—J. Everett Light, Superintendent of Schools, Rushville, Indiana

Topics: A. Rehabilitating a library—J. Everett Light

B. Principles in Planning New School Libraries—Margaret I. Rufsvold, Director of Library Science, School of Education, Indiana University

C. Flooring for Libraries—V. F. Kopp, Sloane-Blabon Corporation

D. Light for Libraries—
Henry L. Logan, Vice President, Holophane Company, Inc.
R. B. Horner, Engineer, Wakefield Brass Company.

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* Daylight Saving Time

II. Types of Construction and Materials Which Reduce Costs—University School, Room 220

Chairman—Paul Garrison, Superintendent of Schools, Richmond, Indiana

Topics: A. Residential Type—Edward James, Architect, Indianapolis, Indiana

B. Modified Conventional—Harold Maurer, Architect, South Bend, Indiana

C. One Story—
Walter Scholer, Architect, Lafayette, Indiana
Ralph Legeman, Architect, Evansville, Indiana

D. Other Types—George M. Ewing, Architect, Philadelphia, Pennsylvania

III. Moisture Proofing for Low Maintenance Costs—University School, Room 204

Chairman—Joseph Rice, Superintendent of Schools, Elkhart, Indiana

Roofing, Flashing, and Moisture Proofing—
T. K. Schuyler, Tremco Manufacturing Company
R. W. Ehrenburg, Vice President, Brisk Waterproofing Company

IV. Community Participation—University School, Room 216

Chairman—Cecil Sonner, Superintendent of Schools, Charleston, Indiana

Topics: A. At Downers Grove, Illinois—Jack Elzay, Superintendent of Schools

B. At Mason City, Iowa—Lawrence H. Shepoiser, Superintendent of Schools

WEDNESDAY EVENING, JULY 11

8:15 p.m. Discussion Groups

V. Floor Coverings—School of Education, Room 124

Chairman—E. E. Glenn, Superintendent of Schools, Boonville, Indiana

Topics: A. Painting Floors—Baird K. Eaton, Endur Paint Company

B. Linoleum, Asphalt, Rubber Cork, and Plastic Flooring—
W. L. Johns, Armstrong Cork Company
V. F. Kopp, Sloane-Blabon Corporation
J. B. Albee, Maple Flooring Manufacturing Association

VI. Heating and Ventilating—School of Education, Room 125

Chairman—A. G. Kerr, Superintendent of Schools, Columbia City, Indiana

Topics: A. Radiant Heating—
J. M. VanNieukerken, Copper and Brass Research Association
N. B. Honnigford, Radian Tile
J. E. Goff, Ceilheat

B. Convector Heating—Pinkney Varble, American Radiator Corporation

C. Ventilation—W. F. Currise, American Blower Corporation

VII. Sound Treatment—School of Education, Room 129

Chairman—Kelro Whiteman, Superintendent of Schools, Alexandria, Indiana

Topics: A. Acoustical Plaster and Tile—Robert F. Seery, U.S. Gypsum Company

B. Metal Acoustical Materials—R. F. Batchen, Detroit Steel Products Company

C. Spraying Acoustical Materials—Sprayed Insulation, Inc.

D. Sound Treatment with Glass Fibers—B. F. Leaman, Jr., Owens-Corning Fiberglas Corporation

THURSDAY MORNING, JULY 12

9:00 a.m. General Session—Auditorium, University School

Chairman H. B. Allman, Director Summer Session, Indiana University

"School Building Needs in the State of Indiana"—Wilbur Young, Indiana State Superintendent of Public Instruction

"Future Trends in School Building Planning"—J. W. Cannon, Advertising Manager, *Nations Schools;* Howard Eckel, Director of Research, American School Publishing Corporation

12:15 p.m. Adjournment—Frank G. Lopez, Senior Associate Editor, *Architectural Record*

Rooms may be obtained by writing Mrs. Alice Nelson, Director, Halls of Residence, Indiana University. Conference guests are welcome at the University Cafeterias, the Union Club and the University School Cafeteria.

Address inquiries to Paul W. Seagers, Associate Professor of Education, Indiana University, Bloomington, Indiana.

Conference office, Room 241, School of Education.

SOME RELATIONSHIPS BETWEEN THE UNIVERSITY AND THE PUBLIC SCHOOLS

WENDELL W. WRIGHT

The relationship between the University and the public schools is a subject about which we have thought a lot around here, and I want to take just a little time to think with you about it.

We are working at the same job. About 25 to 30 per cent of your youth coming out of the public schools will continue their education. We here are concerned with the job of helping them to continue in that growth. So, in a very real sense we are working at the same job, and we have a very permanent, close relationship in that area.

You in the public schools, and we in the colleges and universities, are the perfect source of supply of teachers and administrators to the degree that we each have a vision of the possibilities of this responsibility. Only so far as we carry it out shall we succeed in this purpose.

For example, whatever you have done for the teacher teaching mathematics in the high school, you have had 12 years to do, and we have had four years. It is the total responsibility of us both, and not the responsibility of the teacher training establishment alone.

I would like to illustrate that in a very interesting way which was worked out here. A few years ago it became apparent to all of us that we should increase the output of teachers in elementary education. In 1946 we graduated 32 people in elementary education, and this year we graduated 225. How did we do that? The theory has been that it was up to the colleges and universities to interest young people in that field. We started on that program of interesting young people, and we found it was not successful.

We had some people here who studied the problem. Dr. Fox and Dr. Richey studied where and how people make up their minds to go into teaching. They found that most people who plan to teach made their decision at about the junior year of high school. The changes were relatively small after that point.

From this, it was apparent that we were not going to be able to do the job—the decision was made before the students ever saw a university campus. We then began to work with you to interest young people in teaching while they were still in high school. So, there has developed in many cities in the state a real interest in interesting people in teaching in the elementary school. The schools themselves, in their guidance work, began to interest the right kind of people in teaching. As a result, not because of what we have done but because of you people in the field, our enrollments have gone up, especially in elementary education. We would like to say we planned it that way—but we didn't plan it that way. In reality, you people have done it.

So you and we are both responsible for the kind of teachers we have. What kind of job have we done? Well, girls majoring in elementary education seem to be very outstanding people. Last year we selected nine "queens" on this campus, and eight of them were elementary education

majors. In addition, and here is better scientific evidence, we have tried to classify the socio-economic level of girls in college. In testing girls in elementary education, we found that this group of girls you have sent here were above the average of all University students in all the aspects measured. This shows that we have developed a very unusual group of young people who plan to teach in the elementary schools.

That is merely a second illustration—a third one is in the same field. As you know, we are carrying out a program of student teaching, with your cooperation. We are now operating in some 26 school organizations in Indiana, and are decreasing the number of people who do student teaching in the University School. We knew before, and know so well now, that we could not do this without your cooperation. Although our faculty had decided before we did that it was the thing to do, they had not made the change, as there is nothing harder in the world to change than a college or university. However, an emergency arose which made it obvious that we could not place all the student teachers in our own schools. It meant we must either go outside the vicinity for student teaching, or not get the job done. Now we see that extending the student teaching out in the state was the thing to do. That, of course, is cooperation.

We do not pay your teachers for their real service, as you know—we cannot and never will be able to do so. That service is in teacher education, toward which the public schools are making a real contribution.

I now want to change to another, different aspect: In what ways can the University help the public schools? This is a policy question.

Many young people wish to attend college after graduation from high school, but are unable to leave home, or have to work, or plan to attend college on a part-time basis. The needs of these people have been met in such states as California by means of the junior college. In Indiana our extension centers are attempting to meet these needs.

Over 92 per cent of the high school graduates in Indiana live within 25 miles of a college or university—private or public—which offers at least the first two years of college education. I give you this figure, because many of our people drive in from a range of 25 miles. This state is beautifully blanketed for increased college education "on the home front."

Let me go further. Fifty-six per cent of the students in Indiana live within 25 miles of Indiana University, when you consider our extension centers. I strongly believe in this policy. Wherever people are gathered together, and want to learn, we should help them. Our extension centers are doing this job, and will continue to do it. This is one way we are carrying out cooperation.

Let me give you another illustration. Visual aids are very necessary to the classroom—you need them and use them. However, this has a limitation in terms of cost. We operate a visual aids library—primarily film strips and films—and have approximately 25,000 films and 15,000 film strips. We think of those as a library which could not be afforded by any one school system. We have invested one million dollars in this program. I doubt if many of you could afford that. We can afford it only because we can become the complementary library to every school in the state on a rental loan basis.

This also helps us in teacher education. If we want to show how a film should be used in teaching, we go to the library, get it, and show it. It is a good thing for us, too.

Wherever we can put together our resources and yours to the benefit of both of us, we have struck a good bargain. If it is a good bargain, let's keep it up.

Let me just give one other illustration. The work of school surveys is one to which we give a great deal of time. Within Indiana, we do not charge for the services of our staff. We try to charge for expenses over and above the salaries of the staff. However, we always carry with that the right of research.

Another example of this is Dr. Mort's work in the New York area. The Metropolitan School Study is a better example than I could give. All of these examples make it obvious that cooperative work between the public schools and the university is much needed in education today, and we should continue farther along the path which has been laid out already.

LEADERSHIP IN COOPERATIVE PLANNING

PAUL R. MORT

Education is mainly concerned with people's level of living. I often wonder what makes some generations rise higher than others. Why do most people in our generation chase around like a bunch of ants? A Superior Being must be amused looking down at us. In many respects our generation has it over all others—we're just like a big ant hill.

What makes a people rise? What is it that causes some generations to leave something behind to be remembered by? One thing that impresses me a great deal is something that came out of a vacation trip in England.

I saw Stonehenge, the ruins of the Romans, and cathedrals everywhere. These cathedrals were for the most part built at one time. Here a prehistoric people were moved in some way to haul stone and build Stonehenge. The guess is that it had something to do with the Druids, and that it was a sort of a Cathedral of St. John the Divine, of New York City, in the England of 800 A.D. or thereabouts.

I drove up there one day and saw a shepherd with his sheep—the only human being I could see. The important thing isn't the stones there. The important thing is that a group of men somewhere had been moved to build Stonehenge. The generations that followed them didn't leave anything until the Roman civilization built highways and towns. Then more and more generations came and went, did trivial things, and died leaving no sign, until six, seven, or eight centuries later something moved a generation to build those cathedrals. They are now sort of a nuisance to keep, but think what they must have meant to those people who were moved to build them.

This was inspired by a guidebook I read. It said that the cathedral I was looking at was built by local people, the same kind who were walk-

ing the streets that day. I walked among them and thought about what could have moved those people to build those columns and carve those figures.

What makes a people rise to the levels on which they live? We're trying education—education all tied up in little packets that we educators hand out. Will it work? Maybe. But we can supplement it.

In a sense, a university is a great mass of consultants telling things, without the consultees understanding. Nothing is so pitiful as a consultant without a consultee, and yet that is largely what we have today.

I think our great task is leadership in cooperative planning. It is our task as educators to provide the mechanism by which consultees can go to the proper consultant—the university, the museums, or wherever it is.

As I remember, it was a religious organization which made possible Stonehenge, from which local self-government grew. It gave them the power to build the cathedrals.

It is possible that there's something wrong with the machinery by which we can rise. I think there is. Our framework of government is based on the fallacy that we have the answers and can give them out. Well, you can fool the people for a while, but sooner or later they will find out, and they won't want it. We cannot build the great cathedrals by putting ourselves on a pedestal.

It's a little disappointing to see the level of life we've achieved. In the first place we must set up machinery for group thinking on better living, for adults. The best place to start is to talk about the community and what it does for children. Somebody asked a man just back from Korea what we can do to settle that mess, and he said: "Look after children." If we can just do this in a community—look after children—heaven will look after itself.

Has my boy gained from school and home life that which will make him strong mentally and morally? Don't you wish you could be sure? How much consideration have we given to the thought of what school does along this line?

So, I give you a machinery by which a community can start thinking about doing things for the sake of children. We don't rise much higher than we rise in providing for the welfare of these young ones. Folks will seek answers we don't have, and we'll have to work it out together. This gets boards of education and trustees worried. They feel that by law they represent the community and that the decisions to be made are theirs. You back them up and say they should have the final say on the budget. People don't really express themselves.

Accordingly, one of our big problems is the fruit of short-sighted thinking in the past as to the full responsibility of boards of education. A people lives by folks reaching out and up—by doing—and this has not been taken into account in our board of education setup. It is even worse in the trustee system, where one man thinks he, and not the public, has the responsibility.

I have worked for 10 years with a group of school systems which said that they must cooperate with the community, yet nothing happened. One reason was that the superintendent thought that the board would

think he was talking behind their backs. The board thought they would make the superintendent sore. To a board of education, the superintendent must be infallible.

A group of superintendents worked on this problem, and came out with "A Charter for Lay Participation in Educational Planning." I believe the first step is to lay out such a compact as these men did with the board and lay people.

This group felt confident that they could set up what they wanted to without consulting board members—no one had thought of doing so. This is a common thing. We just don't think of including board members in these things. A charter, however, should be entered into as a sort of compact by lay groups, boards, and administrators before going into this unknown territory. If you really use this, you're going to tap the forces which built those cathedrals.

So, we'd better take a little time—like the Pilgrims did on the *Mayflower*. One of the most important things that the charter to which I was referring says is that the educational program is the concern of all the citizens. You don't really believe that. Better examine yourself before you sign the charter—most school people don't really believe it. We try to keep people from participating. You don't really believe that groups in the community should have a voice in the school. You think people ought to be bluffed out—if you didn't, you'd encourage people to attend group meetings. Everything which has been written about lay participation has preserved our bureaucracy which keeps people from expressing themselves. Other people's opinions should be brought in. Better sit down and talk it over.

Another part of this charter is the fact that by law the board has the final say. Few people know that school boards are government agencies. Even to teachers they are not government agencies.

People are pretty sensible. They will stay in line in group procedure if they understand the function of educational government. The school board is obligated to carry out the people's wishes. In our system, the local board is vested with certain powers. Participants in educational planning should present all recommendations to the board. They should recognize this before they start. It's a legal fact.

The other day I was talking with a board president in New York. He had had a clash with a young superintendent. The board president had tried to carry on education as he would a Red Cross drive. He didn't realize that educational government is different from any other community enterprise. He had been doing things the superintendent and principal should have been doing. The president of the board of education is not like the president of any other organization. The superintendent will carry out the wishes of the board—the board does not have to go out and do anything about it.

Then something came up about the school and community in that district. The board president had done things on his own without consulting the rest of the board or the superintendent. I then realized that we've never set up the rules for relations between the board, the superintendent, and the public. These are nicely laid out within the school system, but never between the school and the public.

All I'm proposing, then, is that you extend your board rules and regulations to include the public. Yet, there is no set of rules that does that. People don't have a voice in education here in the United States. The average German has more to say about his school system than the average American. Look at New York City—it's more centralized than France, and bigger than many states on earth.

We tried to go into part of New York City and see whether there was a spark of this life in those people who never had any voice in their schools and who had very little voice in government. We took four square miles of over 100,000 people. The assistant superintendent put extra staff in there and tried to see if there was any interest in education.

Everyone said it wouldn't work, but we went ahead anyway. We put down all objections and found that the person who raised the objection usually found a way around it. In this way we got him on our team. This has been going on for over two years now, and is still working.

Those people had never had a voice in the education of their children. They wrote a law to tax themselves in addition to state and city taxes, and one of them found a way to do this legally, without an almost impossible amendment to the state constitution. We found people of a stature to be leaders in America in those four square miles where they had never had a voice before.

This will eventually change the character of government in New York City. Any community of more than 50,000 population is influenced by the same thing and can attack it in the same way.

Out of all the revolutions on earth, only the English and American did not lead to dictatorship. The reason is that a great deal of our government is local government. This makes it very difficult for a dictator to take over.

In the future, someone will point back to the "era when we did our best to eliminate public participation." If you want to see the educator on a pedestal, just take the phrase "adult education." Is it that we're moving to educate adults to our way of thinking? What must it have meant to be one of those who built Stonehenge! What must it mean to be a man in the Bronx who came out with a tax to avoid a constitutional amendment to tax himself!

I'll tell you what it means. Those 15 or 20 people who were leaders have risen to levels of living which they've never reached before. Why box up this freedom? This is what America has.

We tried what was the first free expression of public opinion in many years. It was a very simple device. We just divided people up into groups "helter-skelter." Each group had a leader. He handed out cards so that the people could write down what they thought the schools should be doing. People then read their cards and a discussion followed. In this way, ideas were developed and the people actually acted as checks on themselves.

We did that, and didn't know how it would work. We were scared folks. As these people came in, they just looked like American folks going to a Sunday School picnic. They then broke up into groups, and 800 or 900 ideas came out of that evening. Most poor ideas of people got knocked out by their neighbors. These people were enthusiastic. They

wanted to go to work on those problems. They actually got some state aid and got started on some of them.

There is a great powerhouse in the people of a school district. There is the power that built Stonehenge and the cathedrals. There is the power which is being drawn off bit by bit by this "organized education" but which is not being used as it should.

We have the power in our hands—the power to release this great thing—the power and upwardness of ordinary folk.

THE POWER OF THE PUBLIC

PAUL W. SEAGERS

The term "the public" means different things to different people. To some people it means the small group of people who actively support their ideas; to others it means the small group who make up the opposition; and to still other people it means the large independent group who appear to be uninterested. Actually, any or all of these groups may function as the public, depending on the circumstances. Usually the small groups of pros or cons are audible first and are frequently accepted as representing the thinking and will of the majority. More often they represent vested interests, and the majority does not become articulate except as it is aroused. This arousing of the majority of the general public may lead to violent action embodying many of the characteristics of mob psychology. The power released by this type of action is tremendous and often engenders hatreds and schisms which will take generations to overcome in a community.

The two primary reasons for outbursts of this type are the lack of active interest on the part of the general public in civic affairs and the manner in which we hold public officials accountable for their acts. The power of the public then assumes the nature of a protest power, or a power of accountability. "Throw the rascals out" is often the battle cry. At such times acts may have been committed which are difficult to rectify. With the sweeping reform movement of a protest action, many beneficial features may be lost. Much progress can be engulfed in a flood of public reaction. No one will contradict the fact that this power of the public can be tremendous and very sweeping. It is unpredictable and undependable. It is explosive and may be misdirected even for short periods of time by irresponsible elements and "rabble rousers." Even though the end results achieved through the power of the public in this protest manner may be desirable, the attending dangers accompanying this violent action may offset the beneficial results.

Our forefathers founded this democracy on free discussion by the people in assembled meetings. The chosen representatives of the people knew the will of the people and were expected to govern their actions accordingly. Today, by virtue of the tremendous growth of our country, the change from rural to urban life, the increase in vested interests, and the general complexity of our civilization, the public office holder is hardly able to know the will of the people. Furthermore, the people have

hardly known how to become articulate except in the protest manner. If democracy is to survive, it behooves us to direct this power of the public into creative channels. Let's put it at the front end of the machine rather than at the tail end. Subversive elements would like to keep it as a protest power because it is very useful in the "divide and conquer" technique.

When properly released and directed, the power of the public is dynamic, as is evidenced by bond drives, emergency aid, and even the old-fashioned barn raisings. It is characterized by enthusiasm, generosity, and superhuman efforts all wrapped up in a unity of purpose and a direction of action. Tested techniques are available to use this power. They do not include the releasing of information or propagandizing formerly thought of as public relations but, rather, they involve an honest, democratic form of public relations known as lay or public participation. The participants must be representative of the public both geographically and socio-economically. In fact, all interested people should be urged to participate. Loyalty to vested interests and organizations must be subordinate to the project at hand. Each participant must be willing to study extensively enough to get a background to qualify him for participation without prejudice. Each participant must know the scope of his participation and his relationship to other participants. He must also know who is legally responsible for making the final decisions.

Specialists and experts brought into the planning process must shed all bureaucratic tendencies and be willing to explain in simple language the technical principles involved and the logical way to approach the problems and find the answers. Finally, the public officials must be sincere in wanting the help of the public. At no time must public participation be used as a narcotic just to deaden the sense of an awakening public.

These techniques have been used successfully by many people in various phases of school building planning. It is time now for the school administrator, the school board member, and the architect to take advantage of these techniques and to apply them in a truly democratic fashion to their school building problems. Here at Indiana University we have just finished a film strip in color, showing step by step the application of these techniques. This film strip may be rented or purchased by anyone. It is now estimated that we will need about 19 billion dollars worth of school plants in the United States during the next seven or eight years. If we have the slightest hope of getting the money or materials for any major portion of this estimated need, we will have to tap this power of the public and apply it to the front end of our planning.

LIBRARY IMPROVEMENT THROUGH COOPERATION

J. EVERETT LIGHT

Working on a firm conviction that the library is the hub of any modern comprehensive high school program, we started during the school year of 1946-1947 to plan the improvement of our library situation.

Mrs. Beulah Bishop, our librarian, submitted, in the spring of 1947, such a plan. Nothing was done that summer, however, because of lack of funds, but money was inserted in the budget which was to go into effect the following January.

At that time our library was housed on the second floor in a portion of a large study hall. The library proper could seat 24. Although the library content was reasonably adequate and up-to-date, the environment and facilities were inadequate for study, research, or recreational reading. On the first floor and in the center of our building we had a large study hall, approximately 52′ by 54′, in which were located about 200 permanent type seats. It was decided that this room would be revised into a modernized library that would be attractively laid out and made into a comfortable study home for our students.

Various departments and individuals contributed, in a cooperative fashion, to assure the success of our venture. We wanted the very best, but with the minimum amount of money. C. J. Sellars, the high school principal, had to consider the reorganization of his homeroom programs. Mr. Redman, vocational coordinator, set about in his department making a scale drawing of the room and placing cardboard scaled furniture for tables, files, etc. Mrs. Bishop, having submitted plans a year before, attended meetings, collected literature, and in general re-evaluated the planning already done. Fred Shepler, of our maintenance department, was called in and directed to have his men ready to start work the day school was out in the spring. It would be their responsibility to fix the floor, install new lights, build shelves, and decorate the library. Ben Rifner, head of the art department, had the responsibility of working out a color scheme which would have a high light reflection value, yet be satisfactory to the librarian and be such that the color would create a comfortable and pleasing atmosphere.

We consulted Paul Seagers, building consultant of Indiana University, having him go over the plans of arrangement, lighting, decorating, etc. Dr. Seagers gave us a great deal of help in arriving at our final decisions. The day school was dismissed, in the spring of 1948, our maintenance staff started tearing out the old-fashioned seats and repairing the floor. Mr. Redman had a couple of men begin building additional shelves. We decided to paint our shelves and used odds and ends of old shelving, and thus could use cheap lumber in building of new shelves.

The old creaky floor, 42 years old, was nailed with a 10-penny coated nail in each board. One half inch masonite boards were laid over the old floor and scatter nailed every 6″. We began to have a rigid silent floor. On top of this was laid battleship linoleum of a brown jaspé pattern. In one corner a 12′ by 12′ workroom was set off by shelves of 7′ height. All books, periodicals, etc. come in here and are catalogued and disbursed throughout the library.

In another corner a 12′ by 12′ room is set off by counters 4′ in height. This corner is called the professional corner and is maintained primarily for teachers' use. It is used for committee meetings, conferences, etc. The professional corner is furnished with a table, a leather davenport, and a chair. It also contains an abundance of professional

and educational magazines. The administration will buy for teachers any professional books or magazines they desire.

The color scheme, which seemed a little unusual at the time, is unanimously liked by both students and faculty. The ceiling was painted plain white, the walls a canary yellow, and all woodwork and shelves a dusty rose. The canary yellow has a light reflection of about 67 per cent and the woodwork a light reflection value of approximately 37 per cent. The east side of the library is all windows. These window frames and casings have been painted plain white and covered with white metal Venetian blinds. It is amazing how much more light comes through the window where the woodwork is painted white. Some people feel that white woodwork gets dirty too quickly. The truth is, it doesn't get any dirtier than old black varnish, but you are able to see it and do something about the dirt more quickly. We were striving for a 30′ candle power light at table height at any time, at any place in the room. After doing everything possible to bring in natural light, we decided on fluorescent lighting to finish the job. We have 48 two-bulb, 4′, fluorescent fixtures, arranged in continuous strings of 12 fixtures each.

After planning and then correcting our plans of shelving, lighting, and decorating, it was necessary to furnish our new room. We wanted to use the chairs and tables we had in our old library, but wanted to supplement them with enough tables and chairs to seat over 100 people. After I contacted a couple of our local furniture factories, one of which had already had a part in our new library by making available some hard-to-get materials, the Park Furniture Factory agreed to make our tables, some rectangular, some round, and at different heights. The factory had some prewar oak and used that in making 17 beautiful natural-finished tables. Chairs to match out of natural oak were obtained through the State Industries Office. The leather davenport and chair in the professional corner were manufactured in another local furniture factory, the International Furniture Company. Both companies cooperated to the utmost in giving us an excellent job at a minimum cost.

The library as now equipped provides study quarters for all tenth, eleventh, and twelfth grade students. The junior high school students come to the library on conferences from their study hall teacher. At most periods there is enough seating capacity for an English teacher or social studies teacher to bring the entire class for reference work if he or she desires. The most important benefit, aside from the beauty, color, etc., is the different attitude and the fine appreciation on the part of faculty and student body. We are doing something about good study habits, respect, and appreciation for pleasant environment, etc. This all reflects in the general attitude and work of student body and faculty.

We could easily have spent $12,000 to $20,000 by calling in architects, contractors, etc. Instead, we spent approximately $4,000 for materials and did all the work ourselves. As you can see from the above material, this was not only a school project but also a community project. Not only did the maintenance department, the vocational department, the art department, the library, and the administration cooperate, but also manufacturers and businesses in our community.

If you have an old-fashioned study hall, do not hesitate to get busy to plan a new study home for your student body. Make your library study home the hub of your school wheel.

PRINCIPLES IN PLANNING NEW SCHOOL LIBRARIES

MARGARET I. RUFSVOLD

In a recent book entitled *The American Mind* (Yale University Press, New Haven, 1950) the author, Henry Steele Commager, has pointed out that in America our architecture could be functional—could escape the paralyzing influence of imitation—yet could be beautiful as well. This was a lesson that Americans learned almost unconsciously when they built with native materials for their use rather than for show and profit, and when they allowed their imagination and ingenuity to have free play. It is the lesson which should guide all persons who are involved in school building and planning today.

Function and use, ingenuity and imagination, are familiar terms, stressed in every discussion of this sort, yet often overlooked in even the most lofty architectural planning. We recall the example of the multi-million-dollar postoffice that was built in Pittsburgh, Pennsylvania, a few years ago. This magnificent building was dedicated with great pomp and pride, hailed by all the people of the community—until someone tried to mail a letter. Unfortunately there were no facilities provided for this obvious function!

In developing a functional school library plan, the initial step is a series of meetings involving the cooperative effort of a group of persons who are concerned with school library service. This group should include representatives of the faculty, the parents, and the students, as well as the administrators, librarian, and architect. For no architect can design a functional library suite unless he knows the functions and services that are to be provided by the library.

A satisfactory school library plan grows and develops in response to the needs of the school program—without fear of departing from traditional patterns that are outworn. As an instrument of informative education the library is also, in fact, a method of education. It operates as a laboratory and workshop where individuals and groups have access to the accumulated experience of others. It is the function of the school library to deal with ideas and their communication, no matter what the form or the medium. For this reason the library cannot limit its collections and services to books alone. Such media as broadsides, pamphlets, newspapers and periodicals, maps and charts, museum materials, pictures, exhibits of all types, slides, stereographs, story hours, radio broadcasts, recordings on discs and tape, films, and filmstrips, all have been accepted within the comprehensive scope of the library. At the present time it is true that most school libraries do not provide all of these media and services. Yet all are within the possible realm of any library. It is obvious, therefore, that flexibility and provision for expansion are essential in school library planning.

The group responsible for the initial planning of the school library will be concerned with the following factors:

1. The size and nature of the group to be served by the library is of first concern. Will it serve elementary school, junior high school, or senior high school pupils, or pupils from all 12 grades? What is the total number of persons to be served? Will the library serve adult patrons of the community, and will the faculty be encouraged to use the library for professional reading? At this stage of planning it will be necessary to consider the study activity of pupils and what arrangement has been made for study facilities elsewhere in the school building.

There are two types of library-study halls in current use. In one there is a collection of books located on shelves along the walls or at the back of the large room which is a conventional study hall with permanent rows of seats. Under this arrangement there is a rigid and formal atmosphere with inadequate space and control of library equipment, which prevents many essential library activities and services from being performed. This plan cannot be recommended in modern school buildings.

The second type of library-study hall is one in which the library has all of the desirable features of a good school library and students are assigned to it during the periods in which they do not have classes or other activities, thus making the library the one study center unit in the school. There are educational advantages in having students surrounded by books as they study and in having non-readers as well as avid readers exposed to instructional materials of all types. In some schools, however, the question of the value of a combined library-study hall is economic rather than educational, and the combination is intended only to save personnel. In general, the economic and educational advantages of a library-study hall are obtained only when the pupil group to be served in any one period is a small one. When large groups are assigned to the library because it is the only room provided for study, then either the librarian must put aside the duties for which he was employed, or additional professional assistance is required to supervise the room. No librarian can give individual reading guidance and study supervision effectively to large numbers of pupils in one period, for, in addition to individual pupil guidance, the librarian must carry on many organizational and administrative functions during the day if service is to be provided consistently. A librarian who supervises a large study hall group every period of the day must do so at the sacrifice of library service, just as a teacher would have to sacrifice teaching functions if assigned the study hall function simultaneously with classroom teaching.

There is one other unfavorable condition which is the result of combining the library and study hall. Inevitably the number of students assigned to the library for study purposes is so great that the room is almost completely filled each period; then the library is crippled in performing one of its most important functions, which is to accommodate an entire class of students at one time who come with their teacher to use library materials in a laboratory situation in connection with certain units of work. Classes in language arts and social studies depend upon the library as their laboratory and should be accommodated whenever and as often as the need for laboratory periods arises.

The school library collection represents an investment of thousands of dollars in instructional materials and special equipment. These are centrally housed and administered so that they can be made available at all periods of the day. While it may be very pleasant for John to work out his algebra problems in the library while sitting near his current interest who is using her free period to translate tomorrow's Spanish assignment, the cost to the library may be prohibitive. No one has suggested that the study hall be combined with the science laboratory. Doesn't it seem unreasonable, therefore, to require non-users of the library to study in the library quarters if they do so at the expense of pupils and teachers who need library facilities for accomplishing the day's assignments? Librarians know by experience that the non-user, forced to spend his free period in the library, is the cause of most discipline problems, also. For these reasons, in all but the smallest schools it is impractical for the library reading room to serve as the only study hall for the school.

We have certain standards to guide us in planning the size of the library reading room. In general, schools with an enrollment up to 500 will need to seat approximately 15 to 20 per cent of the students. In schools of 1,000 or more it will be difficult to maintain this proportion, but the proportion should never fall below 10 per cent of the enrollment. It is better to allow 30 square feet per reader than the old standard of 25 square feet per reader, in order to accommodate newer types of equipment without crowding the room. A reading room should never seat more than the number of persons who can be adequately supervised by the librarian or library staff, usually not more than 75 persons. Therefore, large schools will need to plan for two or more reading rooms.

2. The second factor to be considered is the location of the library quarters. Most authorities recommend that the library be centrally located, and easily accessible to study areas and to classrooms. In a three-story building this arrangement would usually place the library on the second floor, but never on the third floor. A library which gives service to the adult community would need to be on the first floor, preferably with a direct outside entrance to the library rooms. In a consolidated school, where the library serves both the secondary and the elementary school, again the preferred location would be on the first floor.

3. Physical requirements of the library program must be determined next. In the initial planning the kind and number of library materials and the activities performed in using these materials will need to be considered in some detail so that the furniture, equipment, and proper arrangement of the quarters may be determined. The present-day school library, if it is to meet the needs of the curriculum, will provide a minimum collection of 3,000 books in small schools and up to 10 books per pupil in larger schools. One running foot of shelving should be allowed for approximately eight average-sized books. If shelving is to be included in the architect's plans, then correct dimensions must be carried out. Dimensions for shelving have been included in almost every article on library planning, so there is no need to repeat them here. It should be emphasized that no shelf should be longer than three feet or it will

sag, and no wall space should be left without shelving, even under the windows and in conference rooms and work rooms.

Because of the trend toward large window areas, most school libraries will find the wall space too limited to accommodate the total number of books required for good library service, and therefore will need to provide some free standing, open stacks, preferably at one end of the reading room. It goes without saying that all shelving should be adjustable and without trimming. The wall shelving should include at least one unit equipped for displaying current magazines and one unit for newspapers. In addition to the shelving for books and periodicals, there should be at least one case for maps, charts, posters, and large pictures; cabinets with closed and sliding doors and adjustable shelves to accommodate recordings of various sizes; legal-sized vertical files for mounted and unmounted pictures, pamphlets, and clippings; and cabinets of proper size for storing slides, stereographs, and filmstrips. Equipment for these materials should be placed adjacent to the areas where the materials will be used.

The card catalog will index all materials in the library and should be located near the charging desk. Unabridged dictionaries and atlases are most conveniently used when placed on special stands. A special table with a book railing should be provided to accommodate *Readers' Guide* and other indexing tools. At least one book truck, two bulletin boards, and a glass-enclosed display area should be provided.

The reading room should have at least one table equipped with playback machines and earphones; slides and filmstrips may be viewed by individuals in the reading room at a table fitted with small projectors and screens. In addition, there should be at least two small listening booths or conference rooms which are soundproof and separated from the reading room by glass partitions to allow for listening without earphones. Obviously, electrical outlets must be provided freely throughout all areas of the library.

Library materials are usually charged out or circulated from a library charging desk. This desk can serve as the booking and charging area for audio-visual materials as well as for books. The old-fashioned U-shaped charging desk prevalent in most public libraries is not the most functional type of equipment for a school library and its cost is usually excessive. Small schools will prefer to use an office-sized desk fitted with special equipment for charging trays; and large schools will prefer a sleek counter, again fitted with special equipment. The charging desk or counter will be located so that it faces the door, not the windows, and should be as close as possible to the workroom and the card catalog. It is always well to provide shelving on the wall behind the charging desk.

Because the school library encourages reading for recreation and for pleasure, it should provide one area with informal, lounge-type furniture, with attractive, well-selected books and magazines close at hand.

Most library reading rooms are rectangular in size, being the same width as the classrooms and the length of two classrooms. However, a wider reading room is more desirable if it can be constructed without pillars. In certain parts of the country one has to choose between a wide

room with two rows of massive pillars down the center, or a long narrow room. Both types are difficult to arrange and supervise.

If films are to be included as a part of the library collection, or if they are to be borrowed from a central agency and distributed from the library, a small preview and demonstration room should be included in the library suite. The room should seat about 15 to 20 persons, and in new buildings it will have no windows. It will be artificially air-conditioned or ventilated. This room should have double universal service outlets at the rear and front placed in load-bearing walls. In addition to the screen and the projector, there should be a table-shelf at the front of the room to hold the loud speaker, the phonograph, or the radio. This table should be approximately 12 inches higher than the general height of the students when seated. The preview room should also contain a desk with a shaded lamp for lecturing or taking notes, a demonstration table, a chalkboard, and a bulletin board. Some storage space should be provided for the equipment which is to be used only in this room. However, the audio-visual materials and pieces of equipment which will circulate for use elsewhere in the school should not be housed in the preview room.

In addition to a reading room, the conference rooms, and listening and previewing rooms, the library will need a work area for processing and preparing library materials. In a small school the work area, the librarian's office, and the storage area may be combined. In all cases this room should have an exit to the corridor. The equipment should include shelves for books which are being processed, large storage cabinets for equipment and supplies, a sink with hot and cold running water, and a work type bench with an electrical outlet. There should also be a sturdy table for inspecting, rewinding, and mending films, and for minor repair and production work. A typewriter, office desk, and office files, in addition to the catalog which holds the shelflist file, are essentials for this room. In large schools it is desirable to have a separate storage area for housing projection equipment, films, and the inspection and rewind table. This area should have access to the workroom on one side and the preview room on the other side. Also, in large schools a small area may be partitioned with glass to serve as the librarian's office.

Libraries in larger schools will find it convenient to have at least one classroom adjoining the library suite. This room will be used not only for instruction in the use of the library but also for classes where it is necessary to use library materials in a discussion situation without disturbing readers.

4. Lighting, color, floor covering, and acoustical treatment for the library will be in harmony with those provided elsewhere in the school plant. Because they are the next topics on the program, our discussion omits this phase of the subject. [A floor plan for a library and a diagram of furniture were posted on the bulletin boards for discussion purposes.]

FLOORING FOR LIBRARIES

V. F. KOPP

The Sloane-Blabon Corporation, of Philadelphia, Pennsylvania, which I represent, manufactures most types of resilient flooring. Crystal-tex linoleum tile is one-eighth inch thick. It is made of linseed oil, which is the base. A wood flour is added as a binder and whitening for a base for the pigments which give the linoleum its color. It is run through a large calender machine that gives it shape and form. It has a neoprene-saturated felt back.

To maintain the linoleum and rubber tile, neutral soap and water should be used with a clear water rinse. Either a liquid or paste wax may be used. The life of the linoleum or rubber tile will be prolonged by 150 per cent if it is washed and waxed properly. A plastic overcoat for the linoleum tile is not advisable, as the drying components of plastic will dry out the linseed oil in the tile.

There is a fairly new product, known as "Koroseal," that far outshines any of the previous tile in the field. It may be referred to as the "Cadillac" of the field. It is a vinyl resin material and is swiftly becoming very popular. There are now approximately five million square feet in use. A one-eighth inch block will wear as long as a piece of linoleum one inch thick. It is usually sold in blocks measuring 9" by 9", 6" by 6", and 36" by 36". It is a pure plastic and is sold in an array of 20 colors and designs, including marble tone, crystal tone, and terrazzo.

The approximate cost of the different products including installation and on contract jobs only are:

	Cost per square foot
Koroseal	$1.15
Rubber tile	.65
Crystal tile	.50
Linoleum tile	.40
Asphalt tile	.20

Questions

Question: What type of adhesive do you use in putting Koroseal down?

Answer: We have our own adhesive with which we install Koroseal.

Question: How long will Koroseal last under normal school use?

Answer: It has not been thoroughly tested, but we figure about four times longer than any known resilient flooring.

Question: Will Koroseal repel chair glide marks?

Answer: Yes, it will recover up to within .5 per cent of its original shape.

LIGHT FOR LIBRARIES

H. L. LOGAN

The first question usually asked of a lighting engineer is: "How much light do we need?" There is no simple answer. For instance, how big is the detail you want to see? If you place a marble alongside a baseball, you can see the baseball more easily. If you have them moved away from you until you can see the marble no longer, you will find you can still see the baseball. If you move the baseball farther away until it disappears in turn, the difference in distances will be a measure of the relative difficulty or ease in seeing the two sizes.

Likewise, the contrast inherent in a particular visual task affects the amount of light needed. If you put a black marble and a white marble on a black background, you will see the white marble easily but will have great difficulty seeing the black marble. If you will now add light to only the black marble until you can see it as well as the white marble you will be surprised at the amount of light you will have to add —it requires at least 20 times as much light as the white marble.

Also, how fast must you see your visual task? People with normal sight can read fine print with one footcandle of light if they have time to study it, but they will not willingly read at such a low level because of the effort they must exert. People can read at 90 per cent of their maximum possible rate with about twice as much light as they require to read at 85 per cent of their maximum speed. To read at a 95 per cent rate requires five times as much light as the 85 per cent rate, and to read at the 98 per cent rate requires about 10 times as much light as the 85 per cent rate. It is impractical to light for the 100 per cent rate, as that takes 10 times as much light as the 98 per cent rate, or 100 times as much as the 85 per cent rate. Natural lighting outdoors is the only feasible answer when maximum speed of vision is required, except in highly special situations such as surgical operations, where it is possible to provide 3,000 footcandles over the small spot needed.

If artificial light was as free and abundant as nature's outdoor light, we could adopt nature's "solution by surplus." As artificial light is not free, we have to determine the minimum illumination levels at which a predicted grade of visual performance will occur, so that seeing will not be handicapped by insufficient light nor more dollars spent for light than necessary.

Various lay people have unwittingly helped to confuse this subject with their well-intentioned efforts. In 1947, for example, a Harvard University committee of nonlighting personnel statistically examined the preferences of the population of the Harvard School of Business Administration on the subject of lighting levels. The committee concluded that "the amount of light falling on the working surface should be of the order of 20 footcandles."[1]

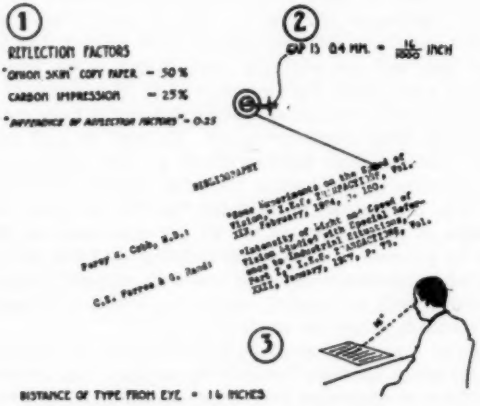
Lighting levels determined in this way ignore the fact that personal preferences are not a reliable guide in matters of this sort. The Harvard

[1] This is reminiscent of the famous Troland report of 1910, calling for 10 footcandles, long since recognized as grossly inadequate.

committee says in effect (although its members may not be aware of this) that the dominant detail in work at the Harvard School of Business Administration is equivalent to 10-point type, as that is the size of detail that can be recognized at 95 per cent of the maximum possible rate on most backgrounds at 20 footcandles.

This is a larger and easier detail to see than is customary in much printed matter. It may be the typical detail in the work at Harvard, but it is not representative of library work. Just as 20 footcandles is too low to permit an acceptable rate of vision for much library work, levels that will permit a maximum speed of vision are too high for practical application.[2] Individual investigation is desirable in each case.

The data to be secured by each investigation are given in Figure 1. They consist of a measurement of the reflection factor of the detail to be recognized and its background, a measurement of the size of the detail, and a measurement of the visual distance at which the detail is to be recognized (16 inches for most reading tasks). There are devices available, such as the one shown in Figure 2, that make the gathering of these data a simple process.



STEPS IN DETERMINING ILLUMINATION LEVEL

Fig. 1. Factors to Consider in Light Needed in Libraries

After the data are secured they are fed into the nomogram shown in Figure 3, or into some other graphical device such as that illustrated in Figure 2. The dotted line on the nomogram joins the positions of the various items of data given in Figure 1, where these items occur on their respective scales. The projection of this dotted line to the 90 per cent, 95 per cent, and 98 per cent visual rate scales shows the illumination levels

[2] A 98 per cent visual performance rate for 8-point type on 55 per cent background requires 85 footcandles—the 100 per cent rate requires 850 footcandles. A 98 per cent rate for 6-point type on 80 per cent background calls for 320 footcandles, and the 100 per cent rate for about 3,000 footcandles.

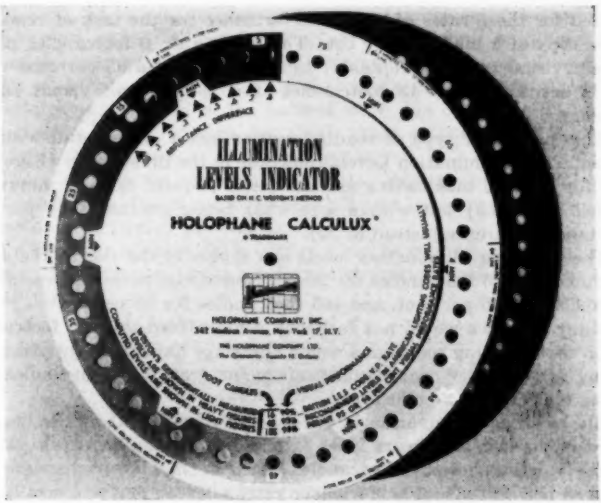


Fig. 2. Illumination Levels Indicator

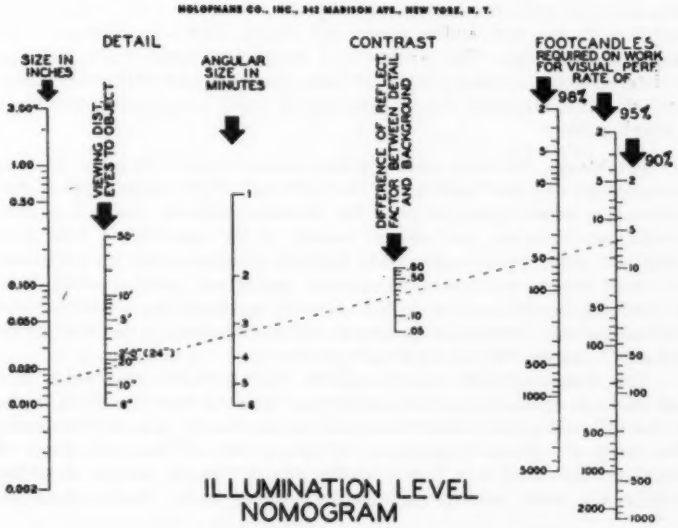


Fig. 3. Illumination Level Nomogram

required for these rates of visual performance for the task of reading a carbon copy of a bibliography list. The levels are: 6 footcandles if a 90 per cent visual rate is acceptable; 15 footcandles if a 95 per cent visual rate is desirable; and 45 footcandles if a 98 per cent visual rate is necessary.

This particular type of reading matter has a large detail with fair contrast. The Illumination Levels Indicator in the illustration (Figure 2) is set for a visual task having smaller detail (8-point type—2 minutes of arc instead of 3.3) but with a somewhat better contrast (40 per cent reflectance difference instead of 25).

The resulting illumination levels are shown in the slot of the device illustrated as: 16 footcandles for 90 per cent visual performance rate, 40 footcandles for 95 per cent, and 105 footcandles for 98 per cent.

Many libraries would not feel they could afford the 105 footcandles level in their reading rooms and would therefore have to be satisfied with lighting for a 95 per cent visual performance rate (40 footcandles) for reading matter with 8-point type.

The average illumination in the reading rooms of 83 of the libraries lighted in the last four years is 41 footcandles. A similar check made in the late twenties showed 8 footcandles. At that time librarians were buying an 85 per cent visual performance rate, whereas they are now buying a 95 per cent rate for reading rooms.

There are many spaces in a modern library, with many different functions. The visual tasks are mild in some, such as the auditorium, and severe in others, such as the map room. Illumination levels at present standards of economic acceptance will vary from 10 footcandles in the corridors to 100 footcandles where the visual tasks are relatively prolonged and difficult. The services of a competent engineer are desirable to determine the minimum level for each space for each different library project, but a suggested list of illumination levels is given on page 35 as a rough guide.

Brightness. The next most popular question deals with glare, or what many people call the "quality" of the lighting.[3] How should light be distributed in visual space so that the observer receives the full physiological, psychological, and optical benefit of the quantity of light provided? In other words, under what lighting conditions does an individual feel most secure, see most clearly, enjoy maximum visual comfort, have to put forth the least effort, and, in general, integrate his visual response with all his other current responses to his environment, in the most effective way? Again, there is no simple answer.

The visual stimulus directly affects one's posture, orientation, and movement in space, hence one's safety and sense of security. This is one of the influences that determines one's sense of ease in an environment. The range of off-axis brightness variations also affects one's sense of visual comfort and is a factor in the rate at which fatigue develops. Finally, the visual stimulus affects one's ability to see clearly along the

[3] "Reflected glare must be abolished. This means that louvered fixtures must never be used: the fluorescent lamps must be shielded completely so that their [reflected] images cannot constitute glare sources under any circumstances." (Parry Moon, *The Second Princeton Conference on Illumination*, printed by Stephenson Brothers, Philadelphia, Pa., p. 61.)

axis of sight, which also influences the rate at which fatigue develops.

Evidence supports the belief that human eyes are specifically adapted to a narrow range of natural luminous environmental conditions. Results of modern research indicate that man's natural habitat, based on the certainty of survival in the natural state (no clothing, fire, or artificial shelter) is limited to a few small areas on the earth's surface in the neighborhood of the 70° F. annual isotherm.

The distributional patterns of natural lighting have been studied, under conditions similar to those obtaining in these rare natural areas, for guidance in interior lighting design.

On the basis of these data, Figure 4 has been developed to define and describe the optimum limits of flux distribution ratios in the human field of view.

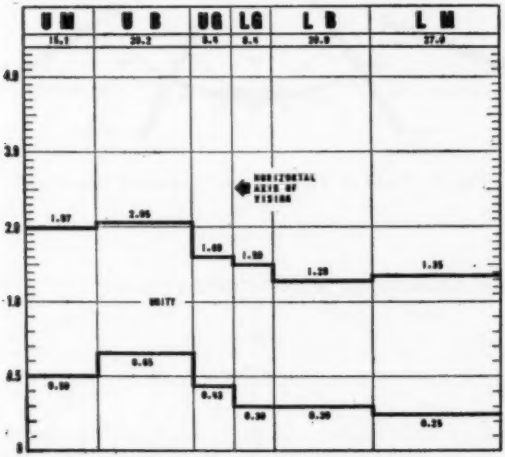


Fig. 4. Optimum Limits of Flux Distribution Ratios

The field of view of the "standard observer," from which the zones of the flux diagram are derived, is shown in Figure 5.

To determine whether a proposed lighting design or an existing installation conforms to the criteria established through the natural studies, the distribution of light is determined for the field of view, zone by zone, as a percentage of the equivalent uniform field, and is drawn on the flux diagram. If the "curve" falls between the limiting lines of the flux diagram, it will show that the broad features of the distribution pattern are similar to natural patterns known to be optimum for man. Such correspondence between the artificial lighting pattern and known good natural prototypes insures that seeing will be sensibly as safe, clear, and easy as under parallel natural conditions.

If the "curve" falls outside the limiting lines on the flux diagram in one or more zones, the "curve" shows where in space the trouble is lo-

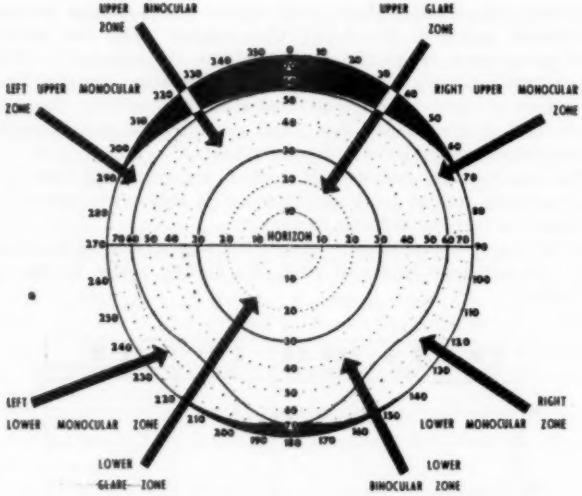


Fig. 5. Field of View of the "Standard Observer"

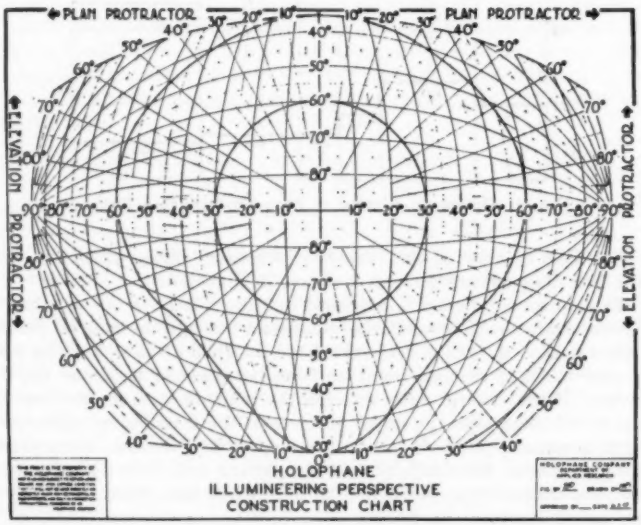


Fig. 6. Holophane Illumineering Perspective Construction Chart

cated (that is, what part of the field of view) and also shows the exact quantitative excess or deficiency in the light from that part of the field. Knowing these things, the necessary steps to bring the lighting design or installation into line with optimum conditions becomes obvious to the trained engineer.

To obtain the flux distribution curve, a perspective of the field of view is laid out from a plan, section, and elevation of the space on a Lambert type grid shown in Figure 6.

The use of the "grid" over the superimposed drawings of a plan and a section is indicated in Figure 7.

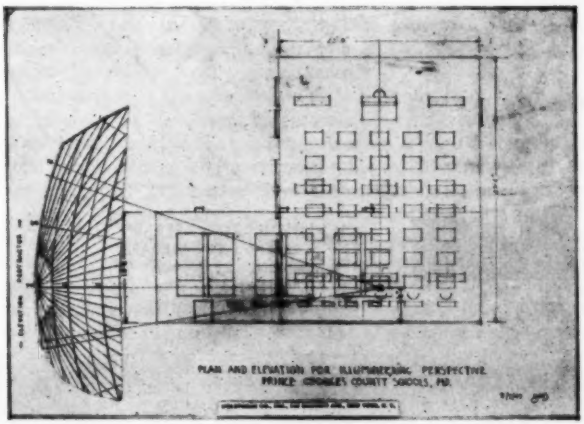


Fig. 7. Plan and Elevation for Illumineering Perspective

All the essential features of the environment are drawn on this Lambert-type grid directly from architect's drawings, and the predicted brightness of each area and of the lighting sources is noted on the developed spherical perspective. The former are taken from standard interflectance tables, and the latter from manufacturer's data.

Such a drawing, for the reading room of a library, with all the brightnesses marked in footlamberts, is given in Figure 8. Figure 9 is a photograph of the actual installation. The light that each area sends to the observer is then computed from this perspective, and from these figures the line segments of the curve on the flux diagram (shown in the lower left corner of Figure 8) are determined.

In the example illustrated in the text, the flux curve shows that the predicted distribution of light in the reading room will be within the optimum range of adaptation of the average reader. From the illumination data we know that the following range of visual tasks can be performed at the rates indicated:

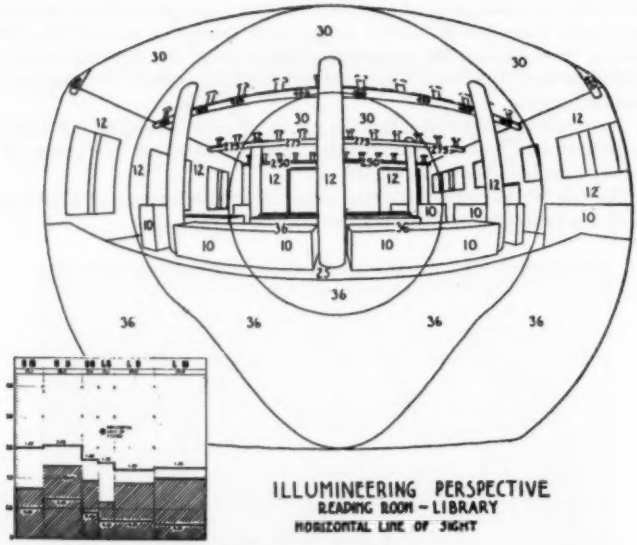


Fig. 8. Illumineering Perspective

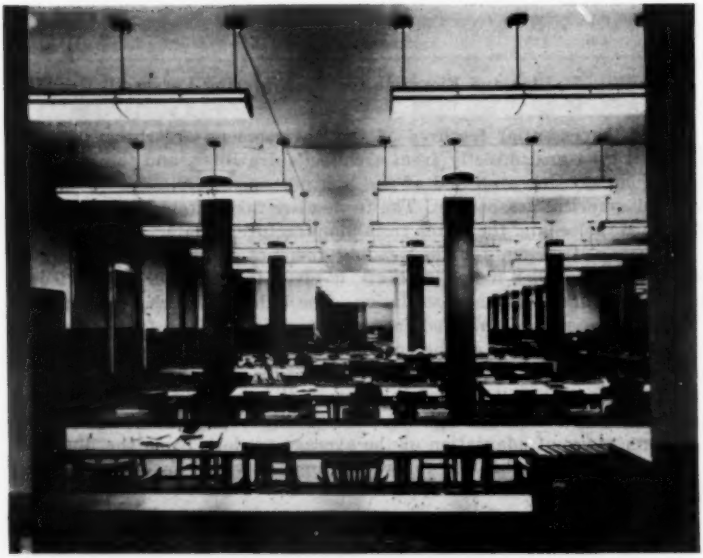


Fig. 9. Library Reading Room

	Visual performance rate
Details at the threshold of vision, with good contrast (1 minute of arc) black on white	90%
Larger details (2 minutes of arc) black on white	98%
Same details with contrasts down to 30 per cent	95%
Same details with contrasts down to 10 per cent	90%
Details similar to 10-point type (3 minute and larger)	
With all contrasts down to 5 per cent	90%
With contrasts down to 10 per cent	95%
With contrasts down to 20 per cent	98%

It is clear from the above that the illumination level (53 footcandles) will permit a 90 per cent visual performance rate with the most severe visual tasks found in libraries, and up to a 98 per cent performance rate for much of the work normally encountered.

It is impossible in the space allowed to do more than refer briefly to the most outstanding developments in recent lighting research. We must pass up the latest data on the predetermination of visual comfort and the work done in developing engineering techniques for the use of color in work environments. It must suffice if this discussion has made a few things clear: first, that there is now a rational, scientific basis for the prescription of economic illumination levels; second, that the economic introduction of "quality" into lighting is dependent on the extent to which the light that is released in an interior is controlled first at the source and then by the engineering selection of the appropriate reflection factors at every surface it strikes; third, that the economic design of lighting systems for work environments has progressed far beyond the point where a layman can be justified in selecting fixtures on the basis of his lay knowledge and requires the assistance of trained engineers.

TABLE OF RECOMMENDED LIGHTING LEVELS FOR LIBRARY SPACES

Area	Recommended illumination in footcandles	Area	Recommended illumination in footcandles
Auditorium	10	Maximum security storage rooms	30
Basement areas (heating plant, janitor's room)	10	Mending room	30
Book order office	30	Music room	20
Browsing room	30	Offices	50
Bulletin boards	30	Periodical rooms	50
Carrells	30	Radio broadcasting studio	30
Catalog department	30	Reading room	50
Children's room	30	Reference room	50
Cloakrooms	10	Shipping room	20
Conference rooms	10	Smoking, conversation room	10
Corridors	10	Special collections	30
Delivery room	20	Staff room	10
Documents	50	Stairways	10
Entrances and exits	10	Storage space	10
Exhibition rooms	30	Teacher's study room	30
Foyers, lobbies	10	Trustee's or director's room	30
Garage	10	Washrooms	10
Map room	50	Workrooms	50

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LIGHTING FOR LIBRARIES[1]

R. B. HORNER

Many of our libraries now in use were designed with as much emphasis on the architectural features of the building as a public monument as to the utilization of the building for library purposes. The modern library should not be merely a storehouse for books; it should be primarily educational, with all of its facilities designed to make available a broad educational program for our students and teachers.

Reading is the visual task that is most often performed in a library. In the recommendation of environmental conditions and lighting levels for optimum reading efficiency and comfort, four factors capable of very wide variation should be taken into account: (1) the condition of the reader's eyesight; (2) the character of the reading material; (3) the reader's intensity and purpose; and (4) the angle between the page and the reader's line of vision.

School libraries serve people of all ages, from our elementary school children to our parents and teachers. As we all know, optical defects are more prevalent among our older people and, although many of these defects can be totally or partially corrected with glasses, some cannot be helped. Although good lighting and seeing conditions are desirable for all readers, whatever the condition of their eyes, it is particularly helpful for older persons and for others who have subnormal or uncorrected vision.

In any library, we will find a great variety of reading tasks, varying from extremely easy to very difficult. Typical of the easy tasks are the children's books, textbooks, and novels printed in 10- to 14-point type, well leaded, on good white non-glossy paper. By contrast are newspapers, printed in 7-point type, unleaded, and on low-contrast off-white paper;

[1] Delivered by Mr. Owen.

law books with their extremely long paragraphs printed in very small type; and magazines with their extremely glossy paper and very small type. The readability of all printed matter depends upon the type size and its contrast with its background, plus such factors as type face, length of lines, spacing between lines, and margin widths. It has been found that two to three times the illumination is needed for pencil work as for average printed matter because of the difference in brightness contrast. The lighting levels and environmental conditions we use in our libraries should be broad enough to compensate for the range and difficulties of the visual tasks enumerated previously.

The third variable is the intensity with which reading is done, or the purpose for which the student goes to the library. Some merely browse or select materials for reading elsewhere; others, as we all know, use the library as a social center; however, college libraries and those designed for study halls or professional research are normally used for long periods of study. With the exception of areas set aside for browsing, the lighting and environmental conditions for all reading areas should be selected with the expectation that they will be used for intensive study.

The fourth variable is the angle between the page and the reader's line of vision. For example, a book printed in 10-point type is seen at its true height only when the book is held at right angles to the line of vision; if the book is laid flat on the table, the type then has an apparent height of only 7-point type. The type width is not changed, but its visibility and readability have been materially reduced.

In lighting the critical seeing areas of the library, much more than the lighting fixtures themselves must be considered. We can spend untold time and expense in engineering and layout of the room and yet have very poor results if the total surround is not carefully handled. The walls of the room should be painted with low chroma, non-glossy paints having a reflectance of at least 50 per cent. These reflectances are available in a host of colors in warm or cool tints. From the standpoint of visual comfort, it makes little difference whether the colors are warm or cool as long as they have adequate reflection. In the hands of a color expert, however, color has many possibilities; rooms can be made to appear smaller by the use of warm tints, or larger by the use of cool ones. Warm tints can be used in north and east rooms to enliven and warm otherwise drab interiors. Conversely, cool tints are often used in south and west rooms that seem to have an overabundance of sunshine. The ceilings of the library should have a reflectance of at least 80 per cent, which means a flat white should be used on this surface. The floors, desks, chairs, and other furniture should be finished as light as possible, with a reflectance of at least 30 per cent, and should have as little specularity as possible to eliminate the reflected glare produced by many of the glossy finishes in use today. If these simple steps are followed, you will not only have excellent conditions for utilizing the light from your fixtures, but you will also have an environment which is stimulating both aesthetically and mentally.

Artificial lighting systems are usually divided into five classes, based upon their distribution of light in the upper and lower hemispheres. We will take up each of these classes and discuss its proper application in

libraries, as a great deal of care must be exercised in the selection of the system to be used in reading rooms, offices, and similar areas where people are occupied with difficult visual tasks and are facing in one direction for long periods.

Judgment must also be made on which of the two types of light sources—incandescent or fluorescent—is to be used. Consideration of the two sources will include the suitability of the luminaire architecturally, the relative initial costs of the systems, and the cost of lighting per foot-candle per year. In general we might say that, for lighting levels used for reading areas, we should use fluorescent lighting if our current costs are greater than 2.5 cents per KWH. As to the suitability of the two illuminants for library purposes, research indicates that for equal levels and quality of illumination, the two illuminants give good visibility, comfort, and readability. Both systems are now being used very successfully in libraries.

The first of the five classes of artificial lighting systems is indirect, divided into totally indirect and luminous indirect. The light from this luminaire is directed primarily toward the ceiling and upper walls, which reflect it diffusely to the working plane. Because the useful light comes from a large area of low brightness, the shadows are at a minimum and reflected glare is practically nonexistent. Of the two subtypes of indirect fixtures, the luminous indirect is preferred over the totally indirect, as the light which comes through the luminous reflector helps to bring the brightness of the fixture up to that of the ceiling behind it, eliminating the high brightness contrast of most totally indirect systems. Luminous indirect lighting gives high quality lighting and is ideal for use in reading rooms and other critical seeing areas.

The second class in our lighting systems is that of semi-indirect, which is similar in character to indirect lighting; however, since more light comes directly from the luminaire, the shadows and reflected glare become more discernible. Because of the brightness of the luminaire itself, it becomes a factor in the decorative pattern which is difficult to handle for high quality lighting.

Luminaires of the general diffuse group direct about equal amounts of light upward and downward. This group includes incandescent opal enclosing globes and bare fluorescent lamps, all of which have strong components of light in the near horizontal angles. The direct glare as well as the reflected glare that results from this lighting system makes it unsuitable for reading rooms, offices, or other locations where critical seeing is of importance. They are suitable, however, for use in hallways and other service areas.

Perhaps the classification we are most familiar with is the semi-direct, typified by the common fluorescent louvered unit. This unit was originally designed with one purpose in mind, to add sparkle and dazzle to merchandise for store lighting. This is exactly what is not wanted in critical seeing areas. In the reflected glare zone, for instance, we have brightnesses in the order of 2,000 footlamberts. This 2,000 is far in excess of the maximum standards allowed in 1920 for enclosing globes, which, as many of you will remember, was three candles per square inch, or 1,356 footlamberts. Yet we see today 2,000 footlamberts being recom-

mended and widely used throughout the country. No wonder we often get objections from fluorescent installations in critical seeing areas. This system is adequate lighting only for displays, hallways, stock, and other noncritical seeing tasks.

The last of our lighting system classifications is that of direct lighting, in which the majority of the light is directed downward. If the luminaire utilizing this type of light is of small dimension, we have exactly the same high brightness problem as in the semi-direct system plus a high contrast between luminaire and ceiling. However, if we expand this luminaire to cover the majority of all of the ceiling and then diffuse the light by suitable means, we have a luminous ceiling, which can again approach and equal the high quality of luminous indirect lighting mentioned previously. The luminous ceiling is a very recent addition to the commercially available field. In one of its forms, it consists of fluorescent lighting mounted on the ceiling, below which are suspended plastic diffusers which veil the lamps and give a quality of illumination which is ideal for difficult seeing tasks.

Undoubtedly, many libraries which have very fine study and reading room lighting have the least satisfactory lighting of the book stacks. Those who are searching for books in the stack area are usually there for a relatively short time. During that time, however, it is necessary to read quickly a great many book titles located on any shelf between the top and bottom. This task is made more difficult by the predominance of dark bindings and their scuffed condition and half-obliterated titles and classification numbers.

Practically, the problem is to illuminate adequately, from top to bottom and end to end, walls of a room with dark walls and ceilings 2½′ to 3′ wide, 15′ or more long, and 7′ high. The logical position of the light sources is on the center line of the aisle at the ceiling; however, under this condition the luminaire may be 6′ or more from the bottom shelves, with the light striking the book titles at a very oblique angle. Because we must look up to read titles on the upper shelves, the glare from the light source must be held to a minimum.

The results of tests with many specially designed stack lighting units show that rows of luminaires using incandescent lamps or continuous rows of fluorescent lamps with proper louvering can provide good uniformity of illumination from the top to the bottom shelf.

In addition, if lighter colored ceilings than those now commonly used in stack areas are utilized, they will aid in the utilization of the light from any unit. Light colored floors will help to increase the illumination on the bottom shelves. Tilting the books on the bottom row of some types of stacks will make it possible to obtain better illumination on the titles and make them easier to read.

I have, of course, been unable to cover many of the special problems which are encountered in difficult libraries. However, in these cases it is wise to have an expert work with you to make a complete analysis of the problem. I can think of no one more qualified for this job than your own Paul Seagers, of the Indiana University School of Education.

The main thought that I would leave with you is two-fold—artificial illumination for the library should never be considered as a single ele-

ment. It should produce no glare, either from direct viewing or from the surface lighted. When coordinated properly with the other elements of the room, it becomes a principal contribution to the educational program of the land.

RESIDENTIAL TYPES OF CONSTRUCTION AND MATERIALS WHICH REDUCE COSTS

EDWARD D. JAMES

Residential type school buildings, instead of being something new, are very old. The first private schools were residential in type. Even in the Colonial days our first public schools were residential in character. Many years later we found certain limitations and shortcomings to the little informal buildings. And the pendulum swung, gradually at first and then with the momentum of the full swing, to large consolidated schools where there was a great improvement in light, air, and heat.

However, the mechanical trades have made many and wonderful strides in diffused lighting and in ventilation, and have developed simple effective heating systems which give the school designer certain new latitudes. At the same time, educators have developed a new approach in teaching which discourages large, regimented room layouts for the lower grades, and even encourages seminar type study throughout the school course. The lower grades only are considered in this dissertation.

The residential type building is in my opinion fitted only to the lower grades, where intimacy and informality assist the youngsters in adjusting themselves to this new and colossal job ahead of them. The architect, to design such a building, must consider the eye level of the clients, the five- to nine-year-old children.

When such consideration is built into the building, then the high ceilings are gone, the monumental entrances are replaced with normal sized doorways, and furniture and equipment are scaled to the pupil. When the teaching is audio-visual, and when guided self-expression is a principle of learning, there must be a flexibility of plan to allow many varied activities in each room area. The room either does not have normal pupil capacity, or, if normal pupil capacity is desired, then the floor area is much greater. In order to satisfy state requirements on ventilation, more air is introduced in the room than is required for the pupil count.

The point of view of the state group is understandable. They feel certain that some day in the future, when the pupil load has greatly increased, the children will again be regimented into the old standardized classroom. I admit such a possibility, even though I feel strongly that a school system would try every method of handling the increased load before wrecking a newer method of teaching in an atmosphere conductive to learning.

The residential style building, I believe, gives the beginner much less mental disturbance when the time arrives to start his school life. Not only are the rooms sized to those of his home, but the building is so de-

signed as to make his normal habits fit those of the school. Therefore, the large toilet rooms are eliminated. Hall toilet rooms are for visitor and not pupil use. Each room has a small toilet room, controlled by the teacher, and the lavatory in the classroom and adjacent to the toilet room is located so as to give the teacher full opportunity of supervising hand-washing without undue argument or embarrassment from the little hellions.

We are breaking away from the old thought that a band of glass extends the full width of the room. We also agree with most architects that the 4' high window sill regulation is a bit ridiculous. We want the windows of the room to look out on pleasant surroundings and to allow sunlight into the room. But we are not figuring the amount of light as a factor in the illumination of the room. Indiana has too many gray days to allow any consideration of such light source. Since we are not considering light from outside, we have the liberty of providing interesting wall areas, and we also again provide a room a bit closer to the normal living room of a home. Each room has a large picture window looking out on an outside gardened classroom and beyond into a park-like playground area. True, only a few weeks in fall and spring are those outdoor classrooms used, but the remaining months of the year they provide a pleasant picture, just as your garden at home is an enchanting sight even in the winter months. The door directly to the exterior from each room makes exit from the building, in case of emergency, a very simple, teacher-controlled problem.

The park-like playgrounds have segregated areas for each room, those areas close to the classroom itself. Of course, there are general play areas for large group play. The grounds are laid out not only for school activity but also for community use, and there are the usual baseball, football, and basketball areas, together with picnic and barbecue grounds. Long before the day the child starts to school he has become familiar with the building, since here is the neighborhood play and recreational area.

There are so many cold days in Indiana that quite often a portion of the pupils request to remain indoors and thus lose the needed exercise. Radiant heat gave us the opportunity to soften the elements and provide a warm shelter out of doors for those many cold days. The idea is not new, one of my friends from World War I has practiced it these many years in Zurich, Switzerland. He and his associates, both there and in Germany, have provided such a porch on the lee side of the prevailing winds. The Germans call it a Pausenhalle. It is open to the south, and adjacent to an activities room to the north. If the weather is just too bad for playground use, the Pausenhalle can still be used in conjunction with the activities room and there will still be a bit of fresh air for the pupils.

The residential school has the usual covered walkways and the hard-surfaced play area that doubles for a parking lot for night meetings or other community activities in the building.

The ideas that make the residential school a possibility have been presented to you people time after time. The educators of the country, in my opinion, have progressed to a point far beyond the thinking of the

architects. The thinking of the architects too often is the result of client demand. I am certain of one point, the client must be receptive to the modern thinking in educational buildings if the architect is to give the latest in school planning. Generally the architect's failures are based on programs where the owner without intent ties his hands with a definite plan which the owner wants clothed in brick and stone. So, let's talk about the client's job.

It is the duty of the client to give complete information on space requirements, on use requirements, on budget limitations, and on income required for amortizing the debt. It is equally the duty of the client to be receptive to the development of the plan, and he certainly is not fulfilling his duty when he demands a fixed plan or a fixed architectural style. The architect will interpret the space requirements, the use requirements, etc. into an existing building. His job is more than the preparation of plans and specifications and the letting of contracts for construction. These papers, these plans, are only the vehicle, the necessary means of explaining the requirements of the building to the craftsmen who must do the actual labor. The terrific task of correlating the different parts of the work is the job of the general contractor. But the equally large task of checking shop drawings and the minute inspection of the actual construction is as important to the owner as the work done in the design room of the architect's office.

Again, to say it more simply, the architect's job is to represent the owner in securing a completely constructed building. There should be no middle ground, no one should employ an architect for sketches alone, for plans and specifications, or for any part thereof. The architect can serve his client only if he is commissioned to give his client the full scope of his office, and then the owner will always have a representative working for the interests of the building.

The architectural style of today is going to live. Today we have the only architectural style that is truly American. It started way back when we changed from load-bearing walls to skeleton construction, but we didn't know how to handle it. Today we know that we allow our architecture to express the function of the building. We do not cover the exterior with silly ornamentation for the satisfaction of the client—we no longer can afford such extravagance. But this is not new. Study each progressive step in history and you will find that the succeeding years of architecture are directly related to the people, their habits, and their economies. Economics has given the middle of this century a style of architecture. All the governmental regulations, all the radio propaganda will be to no avail, because we today are confronted with the tremendous task of building economically to house the complex necessities of this intricate and vital twentieth century.

The timid of my profession prattle the platitudes of the past and will soon be lost with the copyists of all past generations. These timid souls give you poorly designed buildings where the decoration of the exterior and interior have been made of paramount importance, and the needs of the client, the necessity for economy, the importance of the plan have been pushed into the background. In short, it is my belief that the problems of today's buildings should be met with an open point of view,

where neither the client nor the architect are tied to a premise, either true or false, that subjugates the use of the structure to an esthetic whim.

No period of years since the building of the pyramids has required so much from the people. Seldom have we been so close to losing all the freedom of thought that the centuries have slowly released to the people of today. The challenge to all of us is tremendous. It is no time for the timid, it is the time for the vital people who believe that tomorrow is better than today because we all have worked together to make it so.

MODIFIED CONVENTIONAL TYPES OF CONSTRUCTION AND MATERIALS WHICH REDUCE COSTS

HAROLD MAURER

Many people in the past have blamed the architect for all that has been wrong with school buildings. These same people believe that the new buildings being erected are the answer to all past mistakes.

It is my belief that much good has been done in the way of building in previous years and that, if there have been mistakes, the blame falls equally on the educator and the architect.

To me, modified conventional buildings can mean almost anything. Here I will think of it as meaning buildings for conventional school practices and of conventional appearance. I am neither for nor against any particular type of building construction, for I believe that, if we all thought alike, our buildings would all look alike.

The schools in the past have generally been built around a symmetrical plan, with a center line to give the appearance of the building balance. Perhaps the plan would center around the auditorium, with various other outside attractions, including the bell or clock tower. Usually there was a single center entrance.

Today, with considerable consolidation, we have found the single, center entrance impractical, for the children unloading from buses need back and side entrances.

In the past we have considered schools set back 75 feet from the street, with a small play area in the rear as adequate. Today we talk in terms of acres for school grounds.

Our schools were once built with rooms no larger than 25′ by 30′ to accommodate 35 or 40 students; now we talk of rooms 30′ by 40′ for 25 students.

In the past our interest seems to have been in the outside appearance of the school. We spent much money on outside trimmings of stone, and made many additions that were not essential. It seems to me that the money should be spent on the inside, where the students can benefit.

Therefore, the plan of the floor area is most important. It is here where the teaching is done, not on the walls, or roofs, or bell towers.

Other strides on the inside of the building would include the new acoustical ceilings as against plastered ones. Floors are no longer made of wood, but are fireproof, easier to maintain, and much more beautiful. Blackboards have undergone a transition from the conventional black to various colors, notably green. Dr. Seagers has done much in the state of Indiana to bring new and beautiful colors to our schools.

We are moving forward today in the planning of better schools. A building will stand as a model for only a few years. In the building and construction of new schools, the architect is the coordinator of the experts' opinions, which he must interpret in terms of the money available.

The schools in Indiana today, and the building program which is needed, are seriously limited with the 2 per cent limitation of assessed valuation now in effect.

ONE-STORY TYPES OF CONSTRUCTION AND MATERIALS WHICH REDUCE COSTS

WALTER SCHOLER

The following plans and figures presented for some one-story schools that we have built recently are not guaranteed to be good; we do not yet know whether they are good, for the schools have not been built long enough or used enough to know their true worth.

To begin with, it is often difficult for the architect to make detailed plans of a particular school, for the board of education frequently changes its opinion as to the necessary size of the plant. It is not uncommon for the original plans to specify six rooms and for the need later to be found for 12 rooms. We have therefore decided in favor of a self-contained unit, with each room having its own plumbing and heating system, so that expansion can be made without too much difficulty.

We feel that north lighting, and lots of it, is the best. The windows should be brought down to eye-level for the students, so that they can feel they are out-of-doors. We also advocate lower ceilings.

We have used single-loaded corridors in the construction of these new one-story schools, and we feel that they are wide enough, provided there are plenty of exits leading to the outside. These halls should contain plenty of glass to gain as much solar heat as possible.

Our newer rooms have contained 875 square feet of floor space; we have used insulating concrete floors and have combined roof and ceiling structures. We are using double structural steel beams for additional support.

In the Lafayette school building we have lowered the windows to eye level. We have also lowered the ceilings; in the primary department, one room has a ceiling of only 6′4″. These low ceilings do not "overpower" the little people. Using a center-line plan of construction, we have added the alternate wing.

In building such a one-story school it is necessary to have plenty of ground area, because the building is long. The air is taken in through

the upper end of the corridor and released through the lower end of the room wall.

The construction costs of this school (counting 14 classrooms, or 12 classrooms, library, offices, etc.) amounted to $346,950. We feel this cost to be fairly low and in line with similar buildings we have erected.

We have found that the green chalkboards give off considerable glare. However, we have found it cheaper to heat these one-story schools than the multi-storied schools. This includes the saving of janitor service and maintenance, especially when heating by oil.

ONE-STORY TYPES OF CONSTRUCTION AND MATERIALS WHICH REDUCE COSTS

RALPH LEGEMAN

Any discussion involving the subject of one-story schools is so controversial that a word of explanation must of necessity preface all remarks that I make.

Primarily, all remarks relative to the merits of one-story schools versus multi-story schools, or of what I prefer to call contemporary one-story schools versus traditional schools, must be taken as personal remarks, or rather, personal views. Probably no two architects today will agree in their thinking on the subject, and as a result there is no standard or set of standards for the contemporary one-story school.

The true contemporary one-story school is a new development. Its success or future cannot be attributed to the one-story feature alone. It is a combination of planning, with extreme flexibility of plan, plus free thinking in its execution, all of which must be coupled with contemporary use of materials. This combination alone is enough to make the traditionalist shudder.

To me, the development of the contemporary one-story school has been due to the economic pressure of rising prices. It would be very glamorous to say that it was a development purely as a desire to improve schools, with the cost being the secondary factor. However, in my own experience, the reduction of cost came first, and the desirable features not previously found in the conventional school developed hand in hand with the fight to reduce costs—truly a remarkable procedure.

When we think of our early American architecture, which we call Colonial, was it not a simplified development of the Renaissance of the Old World, economically made necessary by the fact that our forefathers on this continent had neither the bricks, the stones, the labor, nor the money to build so lavishly as they did in England.

Then, when our forefathers felt that they had the facilities to build Gothic on this continent, did they not build a simplified type of Gothic, a form more fitting to their needs and their pocketbook? No doubt they were again pinched for funds and, economically speaking, had to develop a new form of a traditional type of architecture. Today you could probably count all true Gothic structures on this continent on the fingers of

one hand, yet we have come to accept this modernized Gothic in its true light.

This, then, is my justification for feeling that the contemporary one-story school is a product of the times, made necessary by the rising costs of construction. It is also my justification for the development of a new type of architecture which I prefer to call contemporary, one where form follows functions and where useless ornament is eliminated. No doubt, in the future someone will coin a new name for this type of architecture, much more fitting than the name "contemporary."

Traditionally, the school as we have generally known it has been based on a formal plan, irrespective of function, clothed with a traditional architectural type of exterior regardless of whether or not it fitted the plan, and with useless ornament added at random. In many cases, the plan outline has been determined by a predetermined façade, with the rooms laid in as in a jigsaw puzzle. In many more cases, useless ornament has disguised the façade in such a way that we were not sure just what function the building performed.

No wonder, then, that a contemporary one-story school, with its extremely formal appearance, does not appeal to many people as a school. Most of us, whether we realize it or not, are limited in our visualization to something which we have seen. This can readily explain our resentment at such a radical change in our schools.

To illustrate my point of a traditional type of exterior that dictated the plan, I remember one school where, in order to carry out a formal type of façade, with a formal center entrance, the architect provided a two-story classroom wing on the left side of the entrance, then placed a gymnasium on the right side. Then he reproduced the classroom windows in the gymnasium, even though the sills of the second row of windows were some 17′ above the floor of the gymnasium and quite useless looking from the inside.

To illustrate my point as to useless ornament, I remember the school which had quite an elaborate stone cornice, carrying out a traditional type of formal façade. Because of anchorages which had deteriorated, the portion of the cornice over the main entrance broke loose and fell to the ground. Luckily, it was on Sunday when no children were around.

Again, I remember a school auditorium with elaborate ornamental plaster ceiling beams. After 30 years the supports literally became tired, and much of the ornamental plaster dropped to the floor, flattening several rows of auditorium seats, fortunately just after the children had left the auditorium. In another school auditorium, ornamental plaster broke loose during a session of a teachers' convention. This time, several teachers were sent to the hospital, but luckily were not seriously hurt.

Now the extremely controversial statement: One-story schools, properly designed, and with a contemporary use of materials, have proved to be less expensive per square foot of school than the equivalent square foot area built in multi-story construction. I know that this is contrary to all that we have always accepted. Have we not been told that multi-story construction would reduce the roof area and the cost, and that it would reduce the foundation cost, and that naturally the building would be cheaper? Have we not been told that we could build a two-story house

with one more bedroom than we could build for the same cost if we built it all on one floor?

Yes, this statement is still true, if we build a one-story school, and still build it in a conventional manner and in the same way that we have built the multi-story schools. It has been so proved by some architects.

In like manner, we still hear the cubic foot cost of this and that school quoted. I contend that the cubic foot cost of schools is just as outmoded as the conventional school. As proof, I offer the case of a gymnasium built several years ago, where, due to postwar cost increases, the gymnasium was omitted in order to allow the construction of the other part of the school to proceed. We received bids on the gymnasium, however, as a cost index of the times. Fifteen months later, we again offered the gymnasium for bids, but in the meantime we conceived the idea that we were still conventional in our design of the roof; consequently, we revised the plans to reduce the thickness of the roof construction, maintaining the same ceiling height in the gymnasium. When the bids were received, we found that we had increased the cost of the structure one cent per cubic foot because we had decreased the cubical contents considerably, yet the total bids were some $20,000 less. We had the same usable space, the same facilities in the building. My answer to this is a cost per square foot of building, not ground area of building, but floor area of building. The saving in this gymnasium was properly reflected in the square foot cost.

Likewise, in the contemporary school, where we reduce ceiling heights, eliminate high foundations, and eliminate attic spaces, the cost should be rather high per cubic foot, yet very low per square foot. Notwithstanding, we can quote contract prices for such schools, where the cost per cubic foot is even less than the cost per cubic foot for conventional schools.

In substantiation of my claims for a lower cost for the contemporary one-story school, I will name some of the factors. Your imagination can produce many more, and I can assure you that the possibilities of ways in which the quality and use of the school will at least be equal, if not better, are not nearly exhausted.

First, I will consider the construction:

1. The school of which I speak is built directly on the ground, with insulated floors and resilient floor surfaces. This not only saves foundation costs, it substitutes inexpensive concrete floors for more expensive structural floors.

2. It is built on a modular plan, with predetermined units of measurements. This standardizes the construction and allows for more standardization of individual units, for less fabrication both in the shop and in the field, and for less time looking for a special member for a special location.

3. It allows for a lighter structure, because there is no second floor to carry. The roof construction is much lighter than it would be if it were to carry a second floor.

4. Then, considering the necessity for varying room sizes to fit the modern teaching program, the first floor does not have to be overbuilt to carry a different second-floor plan; there are no heavy structural mem-

bers needed to carry that second-floor wall that comes directly over the center of the first-floor room.

5. It allows masonry walls throughout the building, because they can be built on the ground without structural supports. Masonry walls are much more soundproof between classrooms than any form of hollow construction.

Second, I will consider what I have called a contemporary use of materials. Primarily, this consists of finding a material which will do the work of two materials, thus eliminating one entirely, yet will successfully produce equal if not better results.

1. I have mentioned the use of masonry walls. Not only can the interior walls be made of masonry, they can be made of lightweight masonry, with blocks of a type which provide for sound absorption as well as insulation. This allows for the elimination of the plaster on these walls, with the walls treated with an inexpensive water base paint. Many people shuddered when block walls in classrooms were originally proposed. I can understand this, because their visualization was so limited that they thought of a garage wall, or even a basement wall. Today, such walls in classrooms are gaining favor. We have found that they can go without repainting for probably four or five times as long as plastered walls, with even a better appearance at the time of repainting. Then, because of their sound-absorbing qualities, they eliminate much of the acoustical treatment normally required to counteract the effects of the plastered walls. This may be bad for the acoustical material contractors, yet a saving to the public.

2. Another simple way of making one material do the work of two is to allow the steel lintel over the one-story windows to form the roof edge, thus eliminating the masonry above the windows together with an unnecessary parapet.

Now as to the second part of the program—that of the benefits found as a result of trying to reduce costs. I will mention some that come to mind. Naturally, some of them could have been developed in a multistory conventional school; however, considering that they are not conventional, I doubt that they would have found favor in a conventional building.

1. It was found, that, by extending the tops of the classroom windows to the ceiling and eliminating the pocket formed by a lower window head, the ceiling was better illuminated by the glancing light. This caused the impression of a higher ceiling; therefore, it was found that the ceiling height could be lowered with equal results.

2. It was found that the ceiling height in the classroom was further affected by a forest of inverted pendants commonly called lighting fixtures. By mounting these fixtures directly on the ceiling, regardless of the type of fixture, the impression of equal ceiling height could be maintained with a lower ceiling height, yet the fixtures were still at a conventional height above the floor.

3. You might say that this high ceiling height is necessary for proper health conditions. Normally considered, volume is the proper basis for pupil capacity. By reducing the ceiling height, you can increase the floor

area of the room to compensate for this change without adding to the cost. What educator objects to more floor area in a classroom?

4. It was found that we could plan without restriction of outline. We could provide for rooms of any size built for a specific purpose, at almost any location. We were not bound by the necessity of making two floor plans match. We could provide those extra large primary classrooms on the first floor without the necessity of providing oversize classrooms above for the larger children.

5. We found that this irregular outline of plan, justified by functional planning, provided an interesting profile for the exterior, one in which we could clothe the plan with an exterior that expressed the plan, one in which form follows function, one that produced an informal type of exterior, that was not "institutional."

6. We naturally found that stairs were unnecessary. I still have the principal to find who, if he has had the experience of serving in one of these buildings, does not say that the elimination of these stairways outweighs all possible objections to the one-story plan.

7. We found that outside entrances could be provided at will, and that exits could likewise be provided just where they were needed. The next step was to provide outside entrances for primary rooms, for individual play areas under a projecting canopy—quite an innovation for those of us who remember the little red schoolhouse.

8. Again, in our search for improvement, we found that, irrespective of tradition, most teachers prefer a classroom with a northern exposure. By several surveys, we found preference in the order of north first, south second, east third, and west last. With a random one-story plan, orientation is unrestricted.

9. Again, we found that many people had a mental objection to placing a concrete floor on the earth. They thought it produced rheumatism. As a result, we found that, by the inclusion of a thin layer of insulating concrete under the main slab, we not only raised the floor temperature closer to that of the room, but we eliminated the possibility of sweating on those few days of the year when the weather warms, the humidity is high, and the floor is still cold.

You may have many questions which would sound like objections. I can think of two that are consistently put to me.

1. Isn't a one-story school hard to heat? With modern equipment, steam can be conveyed quite a distance, or individual units can be installed between classrooms in utility spaces. As to the heat loss, some time back we had occasion to compare the heat loss of two schools in the same location, one a conventional two-story school and the other a contemporary one-story type. The heat loss of the latter was approximately 20 per cent less than that of the two-story school. Although I couldn't believe this, after sufficient checking I found that the major difference lay in the fact that the one-story building was built on the ground; that the ground temperature, coupled with the insulating type of floor we were using, produced the equivalent of radiant heat in reverse. Thus there was less heat loss through the floor than if the floor were built conventionally over an unheated space.

2. Where can you find room to build such schools? In the case of the

majority of the public schools, the recommended minimum area for a school is ample to house such a structure, with plenty left over for playgrounds. In the case of the urban school, where additional ground to comply with the recommended minimum is not available, this is not true. At that, however, I have in mind the parochial school of six classrooms, where there was only sufficient ground to build a two-story school, with nothing left for playground. After sufficient persuasion, the parish purchased the balance of the block, houses and all, and built a one-story school with a playground and still made a net saving in total expenditure.

All of this sounds like an unending job. It is. Faced with the possibility of still higher costs, we must still search for further ways for cost reduction with at least equal if not improved results. It is like the question recently asked by a superintendent of schools: "Isn't it disheartening to think that, as soon as you produce something new in a school, you find that you have to go still further to produce something newer?" It was a pointed reminder to me that, if this condition had not originally existed, we might still be building only conventional schools. If we are allowed to get lazy and start reproducing the same school time after time, we will not make that progress which may produce the school of the future.

OTHER TYPES OF ARCHITECTURE

GEORGE M. EWING

After a study of the program I assume that you want me to discuss the conventional type of school two or more stories in height. I will speak about materials in a general way, realizing that a material that tends to reduce costs for one type of building can often be used to advantage in another. Let me state that, generally speaking, the most economical materials are the ones close at home. The project should be planned so that a maximum of local materials can be incorporated into the structure, using the best modern methods.

For structure any of the following may be used to advantage:

1. Masonry wall bearing with any of the following floor systems. All are fire resistant type but each calls for the proper engineering selection of sizes and materials. Perhaps the most popular and economical is the use of metal joists of the bar rib type, with a 2½″ thick concrete slab floor finished with soft surface flooring materials. A ceiling of either plaster or acoustic material directly on the underside of the joists hides all electrical and mechanical lines run in this space. The use of precast concrete joists is similar to that mentioned before, but it makes mechanical work more expensive and difficult to hide. Poured-in-place concrete designs, using either beams and suspended ceilings or filler tiles of masonry units with the ceiling material applied directly, are structurally sound and give greater fire resistance, but are subject to the same mechanical difficulties.

2. Poured concrete columns, beams, and girders with slab bays, approximate maximum of 16′ by 30′. Finish top of slab to receive soft sur-

face flooring. The under side of the slabs form fine, smooth concrete ceilings requiring no plaster finish, and the slabs would be sufficiently thick to receive any conduits and pipes of a reasonable diameter. This is an excellent system, definitely fireproof, and perhaps the most economical of any of the absolutely fireproof systems.

3. Poured concrete columns with parallel beams and girders only, using no cross beams. This system would require a minimum of three bays in width and could be used very seldom in schoolhouse structure. It gives an excellent and fairly economical system. The concrete ceilings, being continuous in slab, form no cross beams of any kind projecting below the slab. The slab would be a depth of from 10″ to 12″ and would house conduit and other small pipe.

4. A structural steel frame concrete slab with hung plaster ceiling below. The structural steel should be fireproofed. This type makes an excellent structure but should not be used because of the cost unless the building is multi-story and too high for concrete construction.

For a two-story job where funds are limited, the method of masonry wall bearing with steel bar joists as noted above would be sufficient. I think the best and most economical fireproof system is the second one outlined above.

A new method of concrete slab structure is now on the market. Our office has no direct experience with it, but our men are greatly interested. I am going to discuss it briefly. It is known as the Youtz-Slick method, the experimental and developmental work being done by the Institute of Inventive Research. It has been used mostly in the southwest, and certain projects in the east are now being designed so that the system can be used. A number of nationally known architects, engineers, and contractors have endorsed it. Its developers claim that great savings in costs can be effected by its use.

The method is basically a system for raising flat slabs, poured on other slabs as forms, into position at predetermined heights on the columns. The procedure seems to be: prepare the footings and foundation walls, place columns consisting of either pipe or angles welded to form squares, pour a finished lowest floor slab with a steel trowel finish, place a separation material, set up the lifting yokes at the columns, place edge forms, reënforcement, etc., and then pour the flat slab, repeating if more than one slab is required. When slabs have cured, threaded rods are attached to the yokes and to a hydraulic jack mechanism on the column top. The uppermost slab is then lifted into place near the upper limits of the column and held in place with pillow blocks welded to the column. Rods are then threaded through the top yoke to any lower slabs to be lifted, and the procedure is repeated. This method seems to be most economical for lifting two slabs at a time, or what would normally be a two-story building with roof. Flat slab design appears to call for about a 28′ base with an 8′ or 9′ overhang cantilevered. In long buildings differences between slabs can be made up in plan by spacing ends of slabs approximately 8′ or 10′ apart and locating stair halls or pipe spaces, toilet rooms, etc. in these places or by having poured-in-place concrete in these locations. Present indications seem to call for rectangular buildings or at least combinations of rectangular areas for efficient lifting.

Exterior walls. A very economical wall structure, if wall bearing, would be 4″ of face brick backed with 8″ of concrete block, with an air space about 1½″, and 3″ of furring block. If wall structure were more than two stories in height, which would not be likely, the backing block must be increased in thickness. If the materials were well studied and it was found that they would be of such density that little dampness would come through, the 3″ furring could be omitted, a damproofing sealer being used on the inside of the block before the plaster or paint is applied.

If structural frame is used and the walls are of the curtain type, 4″ of brick backed up with 4″ of block with an air space and 3″ of furring makes an excellent wall. In this type of construction, with fabric or metal waterproofing placed on the spandrels, a positively dry wall can be assured.

Plaster finish would be optional. It of course adds to the expense but it also adds greatly to the appearance of the building.

If concrete block is used, great care must be taken in its selection. Block must be properly seasoned and the mortar used must not be too rich. If the blocks have not been properly seasoned they will shrink and cause large joint openings. If the mortar is too rich, cracks will result in both blocks and joints.

Roof waterproofing. The most effective and economical waterproofing material for the roof is felt impregnated with asphalt or coal tar pitch. If placed in proper number of plies, each of the correct weight, a 20-year guarantee can be had, and if the job is well supervised the material will long outlive the guarantee.

Interior partitions. Interior partitions should be constructed of either concrete block, terra cotta, or gypsum. If no plaster finish is to be used, the block will be economical and, when painted, will present the best appearance. If plaster finish is to be used, terra cotta or gypsum might be more economical, depending on the locality, and the walls might be less likely to show cracks. Metal studs, metal lath, and plaster are often used when a plaster finish is desired. This system makes an excellent wall, but it would be more costly than block, terra cotta, or gypsum with a finished plaster and it has a greater coefficient of sound transmission.

Wood partitions are coming into some use even in a building constructed entirely of fireproof materials. If this type of partition is used, it serves a double purpose, the wood being used not only as finish but as a tack-up surface in certain types of schools, particularly elementary. The wood selected must be of a soft nature. The wood partitions add a domestic appearance.

Ceilings. Plaster ceilings are practical and not too costly. When metal joists are used for structure they should be concealed. Acoustic tile or acoustic plaster may be used, since both of these materials have great noise reduction ability and do not add greatly to the cost. If the slab type of floor structure is used as recommended earlier, no plaster will be required on the ceiling. With today's modern methods of concrete structure, using plasticizer, vibrator, and good smooth surface forms, a concrete surface can be had that is practically as smooth as plaster and

is more lasting and much less costly. If certain portions of the building require sound deadening, acoustic tile can be glued directly to the concrete.

Windows. Double-hung wood sash are economical although, when the cost of paint has been added, the total amounts to almost that of projected aluminum. No sash is more practical than double-hung wood, especially when horizontal pivoting is used for ease of cleaning. Steel sash are serviceable, and the cost is low. They must be kept painted if rusting is to be avoided. Perhaps the best sash to be had today is one of aluminum. They are more economical if projected, but the double-hung are more practical. If the problem is properly studied and most of the upper sash is fixed so that balances and weatherstripping may be reduced and heat loss is reduced to a minimum, double hung sash cost will be near the price of the projected type. Glass block is now being used, placing panels of this material above sections of sash. This is an excellent idea, as it reduces the glare and enough natural ventilation can be had if it is properly designed.

Floor finish. Concrete floor finish is the most economical and certainly the most serviceable of all. However, it is hard to live with in classrooms and other portions of a building where a certain amount of finish is almost mandatory. Of the three so-called soft surface floor materials, linoleum, rubber tile, and asphalt tile, I would select the latter. I think no soft surface flooring material has been developed to take the place of battleship linoleum for service; however, this material can be had in such limited colors that, when used, the floor effect is not good. Rubber tile is the most expensive of the three. The last two or three rubber tile jobs that we have installed have not been satisfactory, due to their tendency to collect dirt.

Generally, it is our practice to use asphalt tile. It is not what I would call a long life material, but certainly you can get 15 years of use in the classroom with proper care. If placed on a positively smooth concrete bed, corner cracking will be eliminated and indentation from chairs and furniture will be slight. It is a material that is very economical to install, has a great range of colors, and can be combined for attractive design at no additional cost.

Equipment. Built-in equipment or furniture, in both wood and metal, is being demanded extensively. This equipment is used for both specialized and general storage. It is principally in the form of cabinets under windows, adjacent to unit ventilators or placed on the long interior wall in some schools, such as elementary, where a lot of cabinet space is required. If the plans have been properly studied for standardization, so that the same type, same design, and same size cabinet may be used in a number of classrooms, the costs will be reduced to the point where the equipment cannot be considered a luxury.

Gymnasium. For gymnasium finish it is my thought that walls should be of hard surface material. There is no need to spend a lot of money for glazed or vitreous brick, but I think that the walls should be of hard brick to a height of 8′ or 10′ so that equipment can be securely fastened in position. Above the brick, concrete block would be very satis-

factory and economical. The structural trusses should be exposed to save the cost of a finished ceiling and maintenance. Where a two-floor divided gymnasium is required, such as for a junior high school, it is our practice not to use large expensive folding doors. We have found that, unless it is a community school where the need is great for a double floor and considerable seating for games, the expenditure for the folding doors is unwise.

When a permanent wall is constructed between the two playing areas the span of the roof trusses can be greatly reduced, thereby reducing not only the cost of the structural members but also the height of the walls that house them.

Auditorium. I prefer to see both walls and ceilings of the auditorium completed with a finished material, and plaster is economical. However, many school auditoriums are being constructed today with satisfactory results with the use of exposed concrete block on the walls. Wood wainscots are not only practical but very decorative. If money is very tight, the floor can be of concrete finish, although asphalt tile helps a great deal. Certainly an acoustic type of plaster should be used on the ceiling or, if acoustic tile is desired, this will give the proper noise reduction. Concealed cove-type lighting is desirable if the money is in sight, but this is rather expensive and exposed fixtures will not only be very efficient but, if properly selected, will look well.

Interior doors. Interior doors should be wood excepting where metal is required to take care of the fire hazard. The frames for the doors should be of metal with integral trim to receive the plaster finish or masonry wall structure. Frames and trim could be of wood at a slight saving.

Heating. If the building is not too large it is my opinion that the best type of heat is direct warmed air. If proper study is given to the design of direct warmed-air heat, it will be found to be very efficient, with the controls very accurate, and not only the capital expenditure but the maintenance and fuel will be economical. The ventilating unit heater system is very efficient but will cost more to install than direct warmed air, and I am of the opinion that it will cost more to maintain and that the fuel bills will be as great. A very good and workable system, but somewhat more costly, is a combination of warm air and radiant heat. If the building is one story high the cost will not be very great, as the radiant heat can be placed in the floor slab on the earth. For a two or more story building, radiant heat should be placed in the concrete bed on top of the structural slab or it can be used in the ceiling. When this type of system is used, the radiant heat should be designed to provide only standby heat and to raise the temperature to the desired degree by the warmed air which also furnishes the desired amount of fresh air.

Lighting. Two types of lighting are available—incandescent which is now rapidly becoming outmoded, and fluorescent which, due to extensive progress in fixture design, is being used more and more. I recommend the fluorescent because of the high intensities now demanded. The louvered fluorescent fixtures in continuous rows give all the light demanded

with lessened power loads and greatly reduced heat output. Continuous development is lessening maintenance costs on fluorescent fixtures daily.

If incandescent fixtures are to be used due to initial cost savings for fixtures, they must be the indirect type, installed in accordance with a soundly engineered layout for proper intensities.

While I am not supposed to talk on programming and planning, I am taking the liberty of doing so for a few minutes. Certainly the wise selection of materials will affect the cost downward to a great extent. However, it is my opinion that the greatest saving to be effected in any project will be by intelligent programming and planning and careful detailing.

The program should be written by one person or a very small committee. Of course, this person or committee should consult the heads of the different departments of the school, but careful judgment must be exercised concerning the requirements of each department. Quite often a department head will ask for much more than can be had under the budget at hand. This overasking may be due to a selfish desire or to the thought that, if you do not ask for more than you expect to get, you will not get what you should have. In programming, the number of classrooms, spaces, and other facilities should be kept down to a practical minimum both as to number of rooms and spaces and as to their size. Where possible, spaces should be used for two or more purposes.

When the program has been established on an economical and sound basis, the building requirements should be carefully studied. Each program calls for an examination of the problem involved, for availability of local materials and workmen, and for available funds both for the capital expenditure and for maintenance. Modular planning, both horizontal and vertical, should be used where at all practical, and stock materials when well designed and applicable should be employed. Classroom sizes and shapes must be studied. Classrooms should be the correct size, not designed for 40 pupils when only to be used by 20. The auditorium should not be too large. Plans should be developed so that corridors will be kept to a minimum but will give the proper circulation. Double-loaded corridors are more economical but generally call for compromising on light and exposure. Ceiling heights in classrooms should be studied. Primary grades do not require as high ceilings as junior and senior high schools. Likewise, the change of air should be carefully considered. Fifty per cent air change is considered standard, and I will agree that this is proper for the early elementary grades, but in my opinion, as the grades advance, the fresh air chance could be lessened.

The economy to be effected in any program depends upon the experience and the ability of the individuals who are in charge. The program must be wisely written, the planning effectively done, and materials selected that will adapt themselves to the principle of reducing costs.

MOISTURE-PROOFING

T. K. SCHUYLER

Moisture-proofing of school buildings is a pretty good-sized subject for a short talk and, in an effort to cover as much ground—or rather,

wall—as possible, I may have to touch on some problems only briefly. At the conclusion I'll be glad to answer any specific questions.

Moisture-proofing of a wall starts at the very top, with the coping. For the purpose of this discussion, the top of the wall we're talking about is like the sketch in Figure 1. It shows the coping stone, the parapet wall, the flashing and counter flashing, and the roof deck. These are the

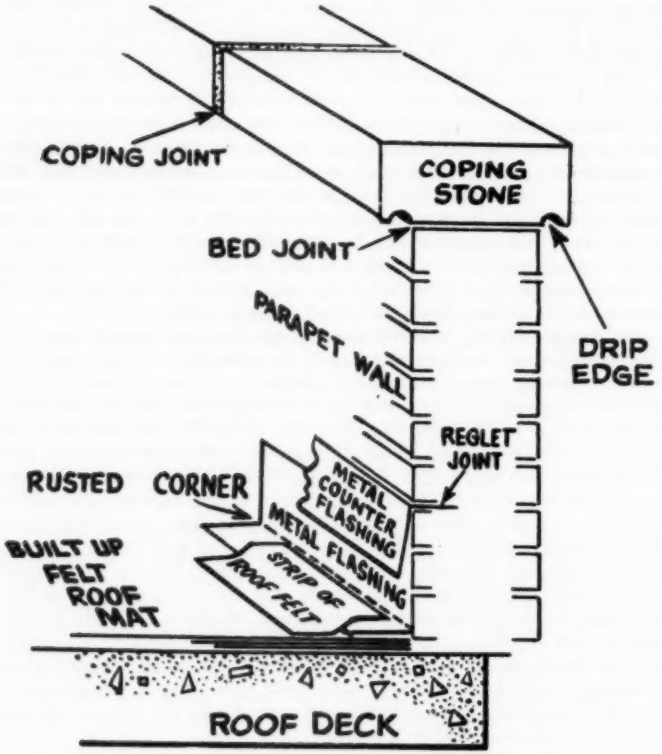

Fig. 1. Parapet Wall

most vulnerable points because (1) coping joints are a source of leaks; (2) copings are often porous themselves, as in the case of cast stone or concrete; (3) parapets are exposed to weather on two sides; and (4) flashings must absorb considerable expansion and contraction. Often the roof is a costly five-ply roof, while the flashing is only a thin piece of metal.

Let's look at each of these vulnerable places for a moment.[1]

[1] It is regrettable that not all of the excellent slides used to illustrate this talk could be reproduced here.

The coping is simply the cap which seals the parapet wall against moisture. If the building has a stone or cast stone trim, the coping is likely to be of stone or cast stone. Tile is often used, and sometimes metal is used.

Coping stones are usually set in a cement mortar and the joints between them are mortared to form a seal against water. This joint is the weak point. Expansion and contraction with heat and cold causes the joint to crack, allowing water to get in. Once water has entered an open joint, deterioration is speedy.

Figure 2 shows some of the various courses that water may take when entering through the open coping joints. Here is a typical joint failure. There are a number of ways in which this problem may be attacked, depending on the specific conditions.

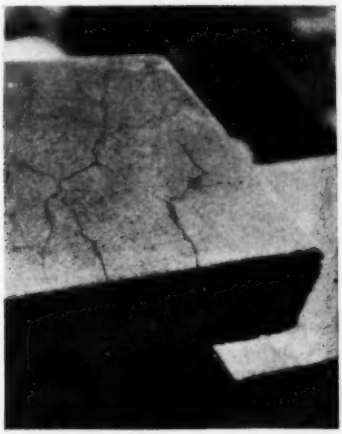

Fig. 2. Courses That Water May Take When It Enters Through Open Coping Joints

To insure good adhesion, the joint must be raked out and be free of loose and crumbling mortar. Then it can be repointed, by using either a caulking gun or a pointing tool. Where excessive movement is present, a membrane should be sandwiched between two layers of a special mastic.

Pointing of the joints alone will never solve the problem where the masonry itself is absorbent. Under such conditions, the masonry must be sealed to prevent deterioration and to prevent water from going through the masonry and into the wall. This may be accomplished (1) by using a transparent water repellent that simply fills the pores of the masonry, or (2) where the condition is more severe, by capping or covering the entire coping with an elastic, mastic water repellent. Where such a seal is employed, it is important that the wall be permitted to "breathe" by allowing an opening between the top course of brick and the coping for the escape of migrating vapor. The moisture comes up from inside by capillary action.

Trouble in the parapet wall usually, but not always, originates in the coping. Strong winds sweeping rain across a roof may produce direct storm leakage, since frequently the inner face of the parapet is not constructed too carefully. If drains are clogged, water may stand above the height of the flashing for several days and thus enter through porous or cracked joints.

Fig. 3. Wall Surface Failure

On interior brick parapet walls, the best treatment is to rake out the joints to a depth of ¾ inch and repoint with a rich mortar of two parts sand and one part cement, with some lime added. It is never advisable to seal the interior parapet wall thoroughly because of the danger of trapping moisture vapor entering the parapet wall from the building itself.

Vapor migration is the movement of moisture vapor, which is moisture in a gaseous form from an area of high vapor content to an area of low vapor content or from an area of high vapor pressure to one of low vapor pressure. This movement to equalize the pressures of adjoining areas takes place even through walls. When the vapor strikes a cool point where the moisture condenses, it is said to have reached a "dew point."

Note how a cold glass of water "sweats" in a warm room. Condensation causes a wall to do the same thing. Water that has condensed in a wall and can't get out is likely to freeze in cold weather and cause spalling. If it can get out, the wall is said to "breathe," and spalling will not occur.

This whole problem of vapor migration is a rather complicated one, and a good rule to follow is to call in someone who has been thoroughly trained in solving these problems. There are definite precautions that must be taken before treating exterior walls. Serious and costly failures are possible if a treatment is undertaken without the benefit of outside advice.

Any general dampproofing program must include close attention to the flashings. The flashing is a vulnerable spot, since it is located at the angle where horizontal and vertical surfaces meet. If a flashing fails, it will frequently admit water into the joint between the roof and the wall. (See Figure 4.)

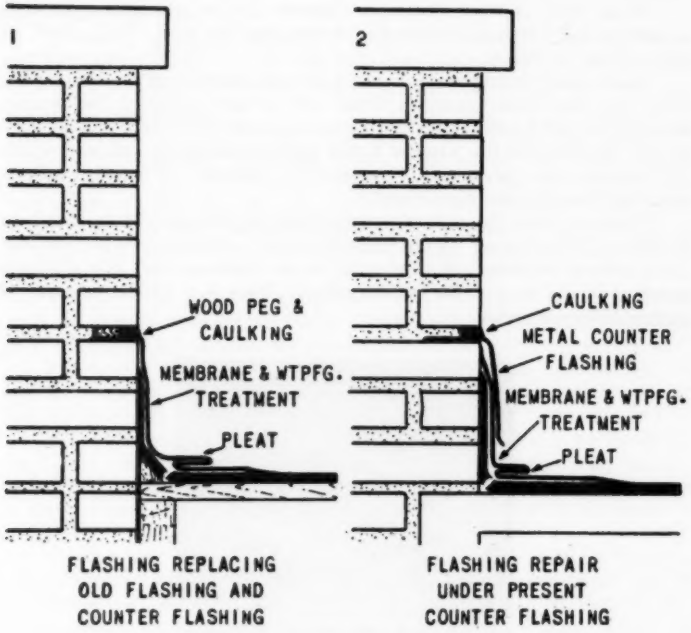

Fig. 4. Overlapping Flashing

Your flashings may be metal or a composition material. Since two opposite flow factors are involved here—horizontal and vertical—a counter flashing is also required. The edge of the counter flashing is generally turned into a horizontal joint in the masonry, known as a reglet.

There are a number of effective ways to repair flashings. One way favored by many schools is the following, because it can be performed by their own men, and is economical as well as effective. This method employs a membrane made of impregnated jute, because it follows the contours of irregular surface so well. The bonding agent should be a static bituminous material that will not sag on vertical surfaces. Application is made so as to allow for movement, usually two overlapping plies, with no mechanical fastening required.

There are a variety of ways to employ this technique, including the accordian pleat flashing illustrated in Figure 4.

Before any general dampproofing treatment can be attempted on the exterior, it is necessary that all joints be inspected for cracks, pointed with a good mastic, and made perfectly tight.

These include joints above and around the cornice, dentils, projecting courses, belt courses, lintels, and sills. All openings around windows and doors should be caulked with a mastic caulking compound.

When wood, steel, or aluminum windows are set into a masonry wall, a crack is left between the window frame and the wall. This crack, of course, must be filled.

Since masonry and wood or metal do not expand and contract at the same rate, the joints cannot be filled with a rigid material like mortar, but must be filled with a flexible material which will adhere equally well to both the sides of the window frame and the masonry wall and which will expand and contract with temperature changes. A mastic caulking compound meets these requirements.

Figure 5 shows the sort of damage that happens around the windows if caulking is neglected. Jambs and sills must be carefully inspected. The joints around windows are vital spots in any building, and only a mastic material should be used for caulking them. Here is a typical example of mortar failure on a sill.

Fig. 5. Sill Failure

The way the workmen hold the gun determines the kind of caulking bead applied. The nozzle of the gun must be flush to avoid too thin or too thick a bead. Too thin a bead may cause premature failure, while too thick a bead is simply wasteful.

The type of building material has considerable bearing on the success of the dampproofing program. Brick and brick facing over hollow tile are the most difficult to dampproof successfully. Because of the problem of vapor migration, touched upon previously, vapor barriers on the in-

terior walls are required if an absolutely impervious treatment is to be applied.

Concrete walls are dense, and if no cracks are present or existing cracks are repointed, a dampproofing treatment may usually be effected without the necessity of an interior vapor barrier. Stucco walls offer little difficulty, as the space within the wall permits the air to circulate and diffuse the vapor.

Generally speaking, there is no one dampproofing treatment which can be recommended over another until all the problems of the specific wall to be treated are weighed and analyzed. For this reason there is a variety of treatments.

There are the transparent masonry preservatives, mentioned previously in connection with coping stones. This is how they work. On an untreated wall, rain is absorbed into the pores by capillary action, and may be able to seep through into the interior. As the preservative is applied, it fills the pores and satisfies the natural porosity of the masonry. With the preservative well into the pores of the masonry, water absorption is halted.

An important point to remember in the application of this kind of masonry preservative is that it is to be applied in the surface rather than on the surface. No surface film should be left.

The easiest way to determine whether it is applied in or on the surface is to observe the gloss. If the surface is glossy, too much material has been applied.

These preservatives should be applied so that the porosity of the surface is just satisfied. This may be accomplished by applying one coat continuously—that is, by applying the material in given areas, observing it after it has soaked in, and going back over the dull areas while the original application is still wet.

Another and very effective treatment is a mastic coating, also previously discussed in the treatment of copings and parapets. Many beautiful protective jobs have been done with this kind of material. It is a heavy, elastic material, 10 times thicker than ordinary paint, which has the ability to expand and contract with temperature change. Its effective life is from 10 to 20 years or more, depending on variable factors.

New procedures have been designed to keep the cost of this kind of treatment to a minimum. Savings are chiefly in labor costs by using special kinds of spray equipment to apply this very heavy material quickly.

There are three kinds of paint for exterior masonry. All act as water repellents in varying degrees. (1) There is the cement base paint—a finely powdered and double-kilned cement with colored pigment. There are many brands available—all about equal in quality. They are effective when properly applied. (2) There are oil-base flat paints. These have the advantage of permitting some vapor migration and are less susceptible to peeling or other failure. (3) There are the gloss oil paints. These provide a vapor barrier and are most susceptible to failure when moisture gets behind them. Otherwise they are quite satisfactory.

The advantages of this "breathing" film of an oil paint is that it acts like a relief valve, permitting a moderate amount of moisture vapor to pass through the film without impairing its adhesion. It will breathe

moisture in a vapor or gaseous form, but will not ordinarily pass condensed moisture or actual water through the film.

Most of the ways in which water enters the wall are through the coping, the flashings, the parapet, the cracks around openings, various joints, and so forth. Other possible sources of trouble are from capillary action from the ground, condensation, and frost trapped in the wall.

If you have a through-wall flashing at the top of the foundation, which is becoming common in new construction, you will have no trouble with moisture migration from the ground. If you do not, you may or may not have trouble with an oil paint film near the ground. At worst, it may have to be touched up occasionally near the ground.

During warm weather immediately following cold weather, masonry remains cold for a period, and moisture condenses on the cold wall. This will prevent any oil base paint from obtaining good adhesion, and peeling or flaking may result later. Moreover, if an excessive amount of condensed moisture is trapped behind the film, blistering may result as this moisture is drawn by the sun.

Immediately following cold weather, frost may remain in the wall for some time, even though the weather has turned warm. This is particularly true on a north wall which is continually in the shade. Dry crystals of ice in the pores prevent proper penetration of the paint. Later, trouble may result from lack of good adhesion. Moreover, when frost does thaw out, the resulting moisture trapped behind the paint film could cause blistering as it is drawn to the surface. Several days should be allowed for walls to warm up and dry out thoroughly.

The presence of free lime is a problem, mostly on new masonry. Moisture migration brings it to the surface, and its action on an ordinary oil paint film produces a soap which rains can sometimes wash entirely away. *It is very important that an oil paint be selected that has a vehicle which is unaffected by free lime.*

Powdery surfaces, such as bad mortar joints, can cause paint failure. But if they have been repointed, as discussed earlier, with mortar or mastic, there should be no trouble from this source.

Excessive porosity of the surface draws so much vehicle from the paint film that only a powdery film is left, with poor adhesion and little resistance to weather. Such surfaces should be primed before the finish coats are applied.

Dampproofing below grade should, of course, have been done at the time the building was constructed, and from the outside. But in most cases, if moisture is getting into the basement, it is not practical to dig around the outside of the foundation and really do a perfect, permanent job of sealing it. It is an expensive operation. Heavy asphalt and membrane extending from the bottom of the footing to above grade would afford excellent protection if done when the building is constructed.

There are methods, however, of sealing moisture from the interior. The most efficient method uses an iron compound. This is composed of tiny particles of iron with an oxidizing agent, which is mixed with water, sand, and cement.

Plaster must be removed, and the concrete or brick roughened. This may be applied on horizontal as well as vertical surfaces. Where these surfaces join, a cove base should be installed to insure a tight bond. In

especially severe cases of hydrostatic pressure, it may be necessary to bleed pipe holes, to pipe off the water pressure while sealing the rest of the wall, and then to plug the holes with a special mixture of cement and a waterproofing agent. This sort of metallic waterproofing may be painted over, after being sealed with a penetrating material.

Questions

Question: Can you point one wall at a time instead of the whole building?

Answer: Yes, this is commonly done, due to the cost of pointing the entire building.

Question: Would the joints, pointed and nonpointed, be water tight?

Answer: Yes, by simply applying mastic over the joint.

WATERPROOFING

RAYMOND W. EHRENBERG

Within the last few years, there has been a tremendous increase in the interest of school people in problems of waterproofing school buildings. School administrators and school board members have been troubled by all the nuisances that accompany leaking, damp school buildings. They have become deeply concerned about the high cost of maintenance of school buildings that leak, because every year, in their operating budgets, they have had to make provision for remedial and repair work. Architects who are alert to the needs of the schools have reflected this growing concern. Indeed, the inclusion of the subject of waterproofing on an agenda of school people such as this one is ample evidence of the intense interest in the subject.

There are, of course, many vital reasons for this sudden alarm, some of which are pertinent to this discussion. Obviously, far too many educational buildings have been found to be faulty in some structural detail, with resulting leaks and a myriad of different kinds of interior damage. The sudden rise in demands for consultation on waterproofing problems prompted the Building Waterproofers Association to make a survey in 11 states to obtain facts that would lead to a better understanding of the problem. It was discovered that, of 2,706 school buildings covered on the survey, 550 were in a badly leaking condition. It was necessary in 142 cases to engage in extensive repair and remedial work and in 80 instances the trouble was so serious that a second repair job had to be undertaken to preserve the buildings. This is concededly just a glimpse at the extent of the problem, but it is real.

With all the competence and ingenuity of the planners of these educational buildings, what happened that caused this tremendous maintenance problem? With so many high-grade, modern waterproofing materials available, what failed? Why did so many leak?

If the answer were a simple one, we have the right to expect that it would have been known long ago. Only gradually, however, have those

concerned with educational buildings come to realize that there are many answers. In a nutshell, the answer lies in the plain fact that effective waterproofing can be had not only by using good materials, not only by employing scientific, practical methods, and not only by uniform and continuous skill and workmanship, but by a combination of all three. One can use the best materials available and go through the motions of applying them properly but, if the workmanship and skill are not of the highest quality throughout, the whole effort will have been in vain. The building will leak. We have had people ask us, "Why should an ordinary masonry wall leak at all?" There are many answers, but one of them—and the compelling one—is that not every bricklayer works with the same skill, precision, and perfection. Workmanship standards vary and nobody has yet developed a foolproof method of guaranteeing complete uniformity and perfection. An inspector would have to stand over every bricklayer all day to make an effort at such uniformity and perfection as would be necessary to attain maximum assurance against leaks.

There is still another factor that explains the keen determination of educational building planners to keep moisture out of their buildings. That is capital cost. In recent years there has been an educational building boom. Last year educational buildings ran to two billion dollars. For 1951, the total will be three billion and, unless international events interfere, this level will continue for some years. All concerned with the financing and construction of educational buildings are asking themselves what they need to do to protect this unprecedented capital investment. They have had bitter experiences in the past and they do not want to go through the wringer again with wet buildings.

It is patent that those of us who are in the business of waterproofing buildings have a direct financial stake in the problem. Those of us who have done a great amount of work on educational buildings were closer to the problem, and perhaps that explains our greater concern. We know, for example, that school administrators and teachers are complaining about the conditions in the buildings where they are called upon to educate youngsters.

Like others, we have engaged in all kinds of waterproofing work. But we elected to narrow our interest to the principal and most difficult problem, the waterproofing of exterior walls from ground level to roof. There are special problems in roofing which we felt had been answered. Similarly, we felt that, while the basement problems presented a number of special aspects and variations, the greatest and most universal trouble was not in basements. We found that almost without exception the general complaint was that exterior walls were the chief cause of trouble. Finally, the question arose as to whether it is possible to install a form of waterproofing in exterior walls that would seal them from top to bottom against driving rains, winter and summer, and eliminate the necessity for continuing repairs, re-pointing, and the like, year after year.

We had used and still use various kinds of waterproofing materials and methods for exterior walls where remedial repair work must be done. But we have not been satisfied with these. For this and other reasons, we have concentrated on the problem of new building construction. When the masonry wall goes up, can it be waterproofed for the long pull? The answer is definitely in the affirmative. It can, and we are doing it.

After much experimentation over a period of years, we developed a method of waterproofing to stop leaks in masonry walls above grade by providing an impenetrable membrane barrier within the wall. Preformed waterproofing units, specially designed for ready installation, are laid in brickwork as construction goes forward. The skilled waterproofers work alongside the bricklayers as the masonry work proceeds. Overlapping joints are sealed completely as bricks are laid. Structural steel, pipes, and conduits are completely sheathed. The entire perimeter of every window is flashed. The system, which is known as the Larson System, begins at the top of the foundation wall and is sealed to the roof flashing.

The material which we use consists of a heavy impregnated mineral felt weighing approximately 35 pounds per square (100 square feet). This material has been specially selected because of its resistance to the action of alkalis and common fungus growth in the wall. It also has the necessary degree of flexibility to allow making the many shapes required without causing it to crack. At the same time, it possesses sufficient rigidity to hold the preformed shape.

The system is usually started at the ledge in the concrete foundation wall where the face brick begins. A special flashing piece is first installed and then the regular-shaped unit is placed on top of it, as will be seen in Figure 1. Thus, any water which finds its way down through the brickwork is automatically discharged at grade.

It will be noted on the cross-section drawing that each unit overlaps the one below it for the depth of one course of brick. This special shingling effect is the unique feature of the Larson system. It provides the mechanical bond for joining the face brick to the back-up construction, thus giving it adequate strength while at the same time providing a membrane barrier which limits penetration of water to the outer four inches of brickwork.

Each piece of the flashing which is indicated in the cross-section drawing is thus carried completely around the building horizontally. Wherever windows or other openings are encountered, the units are sealed to the frame on each side providing, in effect, a continuous protection.

The size of the unit will vary with each particular job, depending upon the size of face brick, width of joints, type of back-up construction, and spacing of the headers. Any bonding can be accommodated, including Flemish.

Many architects have only recently begun to use highly porous cinder block back-up because of the fact that they know the building will be protected by the Larson system. In many cases, the savings afforded by substituting cinder block for brick back-up has more than paid the cost of installing the Larson preformed units.

Tests made at Columbia University show that the introduction of the preformed units does not weaken the wall. The system was thoroughly investigated and approved for installation by the Board of Standards and Appeals in the City of New York and similar official agencies in Boston, Philadelphia, Detroit, and other large cities. Samples of the waterproofing material have been taken at intervals from early installations and they show no signs of deterioriation.

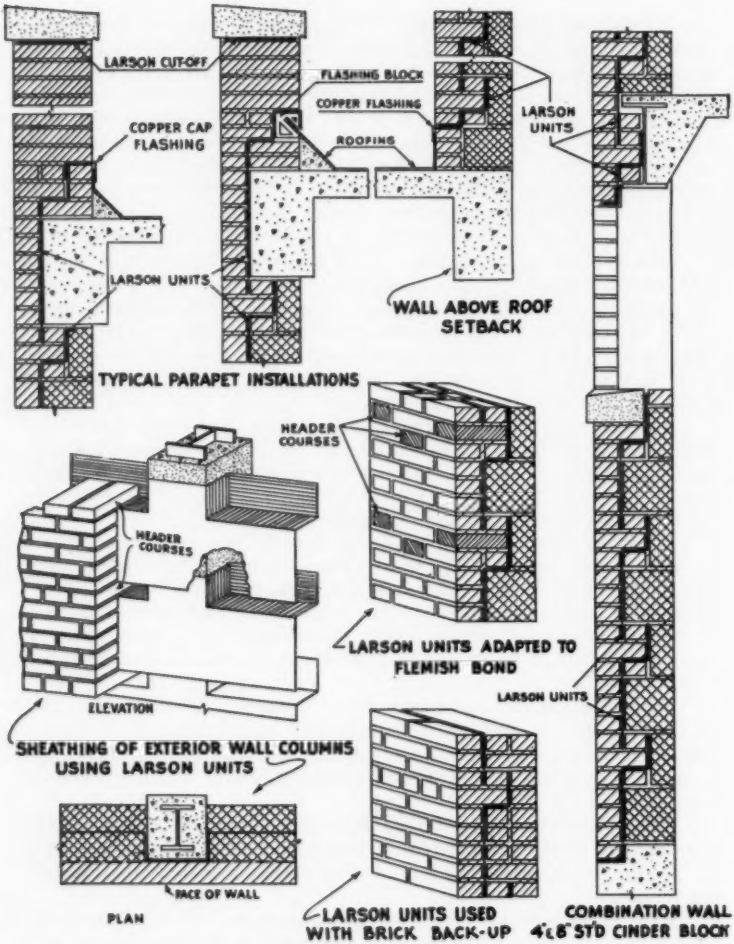

Fig. 1. Typical Details and Sections

Finally, after 17 years of installation of the system in more than 300 educational buildings, we know that it meets the test of time. The exterior walls do not leak. Many architects who specialize in educational buildings use the Larson system in all of their buildings—one of them in 60 schools, another in 30 schools. They know that along the Eastern seaboard, which experienced three violent hurricanes, in 1938, 1944, and 1950, the Larson-treated buildings successfully met the test of driving wind and water. Those buildings are the laboratory proof of the efficacy of the system.

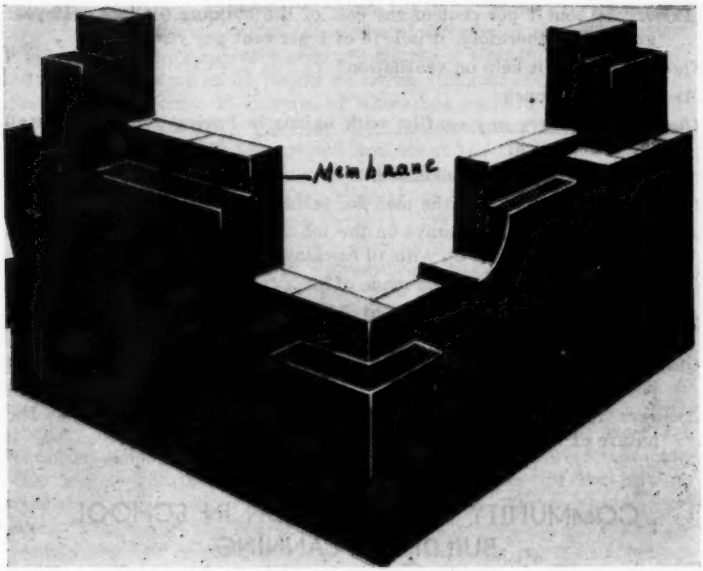

Fig. 2. Cross-Section of Wall

The Larson system of waterproofing is more than a tested system built in the building. Many architects look upon it as a form of insurance against variations in the quality of masonry workmanship, because it makes up for the inevitable deficiencies of ordinary construction work. As a matter of fact, a 10-year guarantee accompanies every installation.

The Larson system can be installed only in new construction, because the waterproofing units must be inserted within the exterior wall itself.

Perhaps a final word on waterproofing generally is in order. We are often called in on problems arising where existent buildings leak and remedial work has already been done—but there are still leaks. There are numerous causes for these difficulties, one being that we have yet to find a remedial method that withstands the guaranteed performance of the Larson system. But frequently we find that, while the specifications for the work required a high quality of materials, the contractor who was employed had little or no experience in waterproofing. His men just did not know how to apply the materials. We urge all who are interested in educational building construction and maintenance to be sure that the waterproofing work is done by experienced contractors who have developed special skills in this field. It is not a job for amateurs and tyros.

Questions

Question: How much does this waterproofing increase the cost of the building?

Answer: About 1 per cent of the cost of the building—it has a 10-year guarantee; therefore, it is 1/10 of 1 per cent per year.

Question: Does it help on ventilation?

Answer: Very much.

Question: Is there any conflict with unions in having your men install the membranes?

Answer: None—we are unionized.

Question: Who furnishes the men for installing the membranes?

Answer: Brisk Company stays on the job until the building is completed —one man can keep up with 10 bricklayers.

Question: What is membrane made of?

Answer: Thirty pound felt about 3/16 inch thick—strong enough to withstand the pressure that will be put against it.

Question: At what depth and at what distance from the wall would you place the drainage tile?

Answer: At the bottom of the footing and as close to the wall as the nature of the soil will permit.

COMMUNITY PARTICIPATION IN SCHOOL BUILDING PLANNING

JACK ELZAY

I am told that the average public school administrator experiences a building program but once, if at all. Even though but once, such an experience is an adequate test of the ability of the school administrator to plan, organize, promote, and execute the spending of more tax money at one time than will possibly ever occur again. I am also told that many otherwise good school administrators lose their jobs over building programs as a result of poor planning, poor execution of planning, or ineffective or ill-directed public relations.

When attending a meeting of the American Association of School Administrators two years ago, I was more than a little disturbed to hear a man of high esteem representing a leading state department of education, in a meeting concerned with community participation in cooperative school building planning, say something like this: "I have heard of many instances in which the community was supposed to have planned the organization and executed the program of promotion as well as have had something to do with the actual planning of the buildings, but you well know it just doesn't happen that way. The superintendent and the board of education tell the others, and the others, if any, do what they are told."

Each of the three thoughts above has some very undesirable implications. It is my pleasant assignment for this annual Indiana and Midwest School Building Planning Conference to tell you an actual story that will prove the fallacy of the three thoughts outlined. As recorded in the columns of a great Chicago metropolitan daily newspaper, it is "a success

story that will warm your heart." Since its initial happening 13 months ago, it has been the wonderful experience of a group of some 200 citizens to take this story on request to over 60 boards of education, civic groups, and university faculties in nearly 50 cities, villages, and towns. At the present time we have 26 citizens, of whom but two are board members, working with seven school districts which are preparing for school building referenda this fall. Let me tell you about the "Seagers Plan"—so-called in honor of the man who gave me the foundation on which to work and who has been a guiding spirit throughout our endeavors. Our story is a take-off on his well executed Orchard Park plan.

Downers Grove, a suburban school community of some 18,000 people, located on the far west side of Chicago, has, since 1941, been the most rapidly growing community of all western suburbs according to population studies and official building records. The community had experienced limited building facilities even before that date. By 1945 school population had increased 21 per cent. Seeing the need for expansion, the board considered asking the public to approve a bond referenda of $300,000. The outcome was absolute opposition, and the proposition was dropped. By 1948 school population had increased 62 per cent over 1941. Libraries, toolrooms, workshops, and gyms had been converted into classroom space. Quarters were being rented in churches for the primary division. Teachers were carrying large overloads. The community was aware of the need. The board of education, in cooperation with the Park Commission, had a community survey made by a recognized agency. Charts and other data, including current population and future trends, were distributed throughout the village and to key organizations. The survey results and recommendations were presented in a series of reports by the local newspaper.

The board of education decided to act. The board prepared a brochure, based on the survey report, which related the story of the need and the plans to meet it. The board had planned two large attractive additions. They approached the people with a $750,000 bond issue. The brochure contained sketches of design and layout. It presented a future step in the construction of a junior high school. As a summation of this episode, since I was not in the community during this time, I should like to quote a statement of the interlocking member of the high school and elementary boards. "This sudden projection of the program by the board with a limited number of public meetings, having board members principally as speakers, was inadequate to answer all possible questions. Strong opposition developed which included many prominent citizens who were willing to sign their names to a last-minute pamphlet opposing both the need and the plan and timed to prevent answer by the board before the election. Many people were so confused that they stayed away from the polls and, obviously, the election was lost. The board learned that it could not attempt to do the job alone, and determined that the various steps would be taken differently the next time."

Public participation in educational planning is not an easy step to take. In America we have been pretty well conditioned to the representative point of view. Cooperative planning is infinitely harder and more laborious. It requires more planning for a board of education and its administrator. But it is the right way. Too many board members see

public participation as an encroachment on their authority. Too often an administrator assumes that any expression of lay interest constitutes a reflection upon his competence. Without public participation, lay people do not see education as their responsibility, and the schools do not receive the benefit of the people's thinking.

The first step obviously is one of planning. There is no one plan. Each must plan for his own community. To be truly representative, groups must include a cross section of people from all working, economic, and social levels. Parents, pupils, teachers, and all interested citizens must be included. The organization must include extroverts and introverts. In every community there are people with intellectual power, there are people with special abilities developed through training and experience. Every community has a wealth of talent in its people. These people hold the respect of the various groups or classes. Such people are the keys to successful cooperative planning. If trained and experienced leadership is not found within the staff, then a competent university field service group is the finest investment. Consideration must be given to the possibility of utilizing the services of an educational consultant.

My first attention in preparing for a promotion campaign was to bring the "opposition" into the fold. Opposition can always be handled. Again, community talent can be used here to advantage. The opposition must be included and involved in the planning from the very beginning. People are not opposed to education, even though they may be opposed to paying for it. Include such people first. Inflate their ego if you must. But never live in fear of them or what they might do. Prepare for all possibilities—answer all the questions before they are asked. Planning must be defensible—it must be thorough, long-range, and comprehensive. Temporary or short-term emergency planning is questionable and therefore vulnerable at many points.

In July of 1949 a small nucleus of people met to develop in a vigorous way an effective educational program for all citizens. A natural outlet was the local weekly newspaper. School news had been typical—nine tenths athletics, one tenth special programs. From this time on to the bond referenda in May, 1950, our one local paper carried 130 news stories covering 1,700 inches of copy—all aimed at making the people conscious of education. All news copy stressed the positive or affirmative side. Never were there words of threat or irritation. When you start challenging in a threatening way, you create your opposition. We assumed, and continue to do so, that if residents know the facts there is no need to take a despondent attitude. Well-informed people will take a positive stand if they realize the need. Articles were generally short, to the point, and interesting. For the most part they were written by persons not directly connected with the schools. Every local medium of communication was used to promote education.

The general need for additional educational facilities was well known. All one had to do was to observe crowded conditions—to drive about the town on any street and see the new homes being constructed. Yet a generalized need was not sufficient. Generalities should satisfy no one. You must be specific—you must have facts. We knew actual school enrollments, but not exact locations. We did not have preschool data, either as to number or location. No prediction instrument was valid,

since our growth was not typical. There were no acceptable data available. The first step in any school building program is to establish exact need as to space and location. A comprehensive school census was the tool needed. It was needed quickly. How was it to be made?

Downers Grove has 56 active organizations. Each organization by a personal letter was invited to an introductory meeting. Forty-seven organizations responded with one or more educational representatives. A cooperative census seemed most logical. The group came forth with the "sectioning" idea, with each organization in charge of a section. No one would need make more than 15 calls and the entire job could be done in a week's time. They were ready to go to work.

A group of 12 representative citizens—a well driller, truck farmer, tree trimmer, minister, doctor, teacher, lawyer, two housewives, two store owners, and a statistician—prepared and keyed the census form. The Hollerith card system was used. All work was a donation. An organizational chairman (a retired business executive) volunteered, as did some 20 other retired residents. These people were to take care of the detail work. No school personnel touched the work from this time to the completion of the data. As one 70-year-old said, "I have always wanted to help, but never before had the chance."

Through the organizations, over 600 residents (including over 200 men) registered as volunteer workers. The committee sectioned the town according to density of homes and schooled the workers in what was to be done and how it was to be done. Every home or apartment was visited. As the returns came in to a downtown office, which donated a private wire and the space, each child in school was plotted on a display map according to the grade he was in. A color scheme of pins was used for identification purposes. On another large display map, drawn to scale, the preschool children from one day of age on were plotted. All children were placed in the exact location of their homes. Vacant lots and homes under construction were also charted. For proper prediction this is essential. As a result of the planning, every block, street, section, or area could be counted with absolute accuracy. We continue to have block captains who regularly report changes within their blocks, and the pins are changed accordingly. This pin map proved to be the most valuable instrument in all the planning and promotion which was yet to come. From it the people gained confidence that the job was being done with extreme care and in fairness. From this instrument, another citizens' group made the preliminary study and recommendations as to need. Citizens determined how much and where. It was nothing some special group threw at them. They had found it out for themselves. Such a technique eliminated all phases of sectional pride of a selfish type in favor of "one community" and "one school system." Such is an invaluable result of community participation in cooperative school building planning. We had the tool—it now had to be put to work.

An open "steering" committee of some 60 members suggested a "slate" of potential chairmen and subcommitteemen. These people in turn voiced their opinion that a member of the combined boards of education should be permanent chairman. This was done, and properly so. The chairman of every other committee was in no way connected with the schools. A board member was assigned to each committee, with the super-

intendent an ex-officio member of all committees. Our particular pattern of committees was as follows:

1. The "steering committee," to whom all committees reported for counsel and evaluation. One or more representatives from local organizations composed this group. There were 60 members.

2. The executive committee. This group of 16 contained the chairman of each committee and the members of the school board. They coordinated suggestions.

3. The finance committee. The purpose of this group was to raise funds for the campaign, by donation, and to serve in such technical areas as bonding and other problems of municipal finance. The committee had 15 members, including bankers, bond salesmen, real estate salesmen, auditors, and truck drivers.

4. The research and information committee. The purpose of this group was to secure all school facts of any type and to serve other committees, as they requested, in any area, such as finance, construction, population, etc. There were 15 persons in this group composed of statisticians, engineers, contractors, carpenters, and estimators.

5. The public relations committee. This group was responsible for the brochure, newspaper publicity, speakers' bureau, house-to-house calls, and other contacts. It included 25 people, among them editors, solicitors, barbers, shopmen, reporters, police, etc.

6. The promotion committee. This group was closely coordinated with public relations, but served more specifically in getting out the vote. Telephoning, delivering brochures, doing special advertising, doing art work, helping with a parade, baby sitting, participating in car pools, and acting as poll checkers made up their activities. This group included 30 persons, with extra help the day previous to the election and on election day. Advertising executives, salesmen, commercial artists, photographers, florists, and deliverymen predominated this group. Housewives were, of course, represented on all committees.

In other words, Downers Grove people shared in finding the facts, presenting the facts, working in the campaign, and paying for the campaign. A citizens' group was included in the selection of competent architects who were willing to respect the point of view of lay citizens. Included as part of the planning for the actual building, a "specifications" group composed of engineers, plumbers, carpenters, masons, construction men, electricians, and the like had been at work. Here was a wonderful opportunity for real contributions. Such a committee was not formed in disrespect for the architects, but rather as a participating group of interested and qualified citizens. They were going to be a contributing part of the whole process and were proud to be of help.

Real estate people who donated all costs and fees, the citizens committees, and school boards worked in close cooperation with the long established community council and park and recreation boards in the selection of sites. Site selection recognized the educational criteria of safety, distance, etc., but also kept well in mind the desire of the park and recreation boards to purchase land adjacent to school sites. Such would be a huge savings of school monies. The park commission will care for the maintenance of all school grounds. This will include mowing, trimming, spraying, snow plowing, and any other needed attentions.

As far as building layout is concerned, all civic organizations, teachers, and pupils had generous opportunities to offer suggestions. Subject areas, such as physical education, domestic arts, science, social studies, etc., were studied by groups composed of pupils, parents, and teachers who drew sketches and provided ideas for the development of these spaces. Maintenance men were regularly a part of these groups, so that spaces and equipment were of the kind that would best serve instruction as well as the maintenance program. Through this means our "anti-everything" groups were included and educated. People cannot argue against need. Enough people were involved so that figures were understood and accepted. Here, in my opinion, is the greatest pitfall. Give important over-all figures and data only. Do not attempt to concern people with detailed figures unless they make specific requests. Unless statistics are in the hands of those who know what they mean, they can be the most dangerous weapon in the hands of the opposition. With a few distorted figures anything can be defeated.

Our ballot was a Chinese puzzle of 44 separate propositions—the largest successful school ballot known. We had the problem of how much and how little to tell—how to give "enough" but not enough to create controversy. We had to have people with (1) ability—men and women who have special talents for special jobs, (2) effort—men and women who can devote hours to the cause, and (3) public confidence—men and women whom the voters would believe. We had to set up a plan that could be timed almost to the day and coordinated so that all the elements fitted together. To do so, we had to find a way to keep all workers enthusiastic. We had the tools—the census showed an unquestionable need. We had an organization. We had the unqualified support of our only newspaper. We had people interested in school affairs. We had the support of all our principal organizations. The potential opposition had been totally eliminated by the simple process of including them.

The day of the vote—May 20, 1950—came. The results, even to the community itself, were amazing. The people shared in a great victory as they had shared in cooperative planning. It gave us a mighty warm feeling.

Many of the citizens, sympathetic with remaining needs, voiced the serious opinion that several years would have to pass by before the schools could "come back to the public" for more. Again the philosophy of need held sway, and the words stated in my earlier statement, "well informed people will take a positive stand if they realize the need," still were ringing in our ears. We allowed no one to cool off. We had a long-range plan developed through community participation, and we proposed to follow it in the same successful way as previously outlined. We were told as before that it could not be done, but 30 days ago we did it. We accomplished the second phase of the plan with exactly the same ratio of favorable votes and the same kind of cooperative effort and organization as before.

Another million dollars over the next 20 years was invested in our boys and girls. You cannot miss if you include the people in the planning.

In the words of the chairman of our promotion activities, "So, you can see it is almost impossible to tell you how we did it. No one person

and no one group was responsible. Everybody did the job assigned to him and, when you get a thousand people all pulling together, it's amazing what they can accomplish. Nearly every community has the same basic tools. Dig them out and put them to work. Your community or any community can put over a referendum, too."

After the successful referenda, a citizens' committee prepared a four-page checklist entitled "Downers Grove School Referendum Inventory." The purpose of the inventory was to discover why people voted as they did. Five thousand copies were distributed to a sampling of the voting population. Over four thousand were returned properly marked. A citizens' group tabulated and analyzed the results. Copies are available to anyone on request. One section of the inventory is devoted to those voting yes; another to those voting no; and another to those not voting. The inventory contains most of the techniques, pitfalls, and pro and con arguments contained in any school referenda program. From the analysis of the results, there can be no doubt that the success story which you have heard was based entirely on cooperative planning in school building programs. People have talent—they want to work for education. Give them a chance to do so. Let your people tell the story. Believe me, they will.

What are my own conclusions? First, you must have an exact need. If you do not, you have no right to make proposals. Second, you must understand what cooperative planning is—what your place is as an administrator, board member, or citizen. Third, as you expect the people to have confidence in your judgment, you must have confidence in theirs. If you aren't going to do so, don't invite your citizens in. Fourth, include and involve potential opposition from the very beginning. Do not take the first step without them. Give them a responsible job to do. Under all circumstances, don't avoid them, but don't argue with them either. Fifth, include every soul who offers to help. There's always something for them to do—never run out of assignments for willing people. Sixth, tap all community resources. Here is a splendid opportunity to include "opposition" as well as to recognize all kinds of local talent. Seventh, make all facts available—do not discolor, reduce, or enlarge. Give the public no chance to lose faith in the board or its administrator by permitting them to find "variations in data or proposals." Eighth, use consultive service if needed. Recognize your own weaknesses or limitations. Gain strength through trained and tested experience. Ninth, never use threat, never get over-emotional. Tenth, do not hesitate to delegate responsibility and give ample credit for services performed. Eleventh, never go in for "deals" and never make commitments which are questionable. (Because of rising prices we completely avoided sketches or layout of proposed buildings.) Twelfth, be a willing and considerate listener—have unending patience—profit from criticism or suggestion. Never get discouraged. Keep your finger on the community pulse.

By applying the above statments you can build more buildings as the need arises. As an administrator, you need not fear the loss of your job, and certainly your citizens will admire and respect you for being a successful builder of community morale, educational and otherwise. Your job is to be of service to your community—*you serve them* as best you

know how. If you know what cooperative planning is, then you know how best to serve your community.

Community Queries

The following questions, picked at random, were asked a minimum of 10 times, either by telephone or by mail, by the voters of school district No. 58, Downers Grove, Illinois, about their recent community-planned school referendum.

We offer these as a guide to those of you who face a program of school facilities expansion. We made every attempt to have the answers before the questions were asked. This is important, for otherwise your program will appear to be an example of poor planning:

Isn't there some way of building up funds over the years so as to avoid referenda?

Why were sites over the years not purchased so that proper locations would be available, thus avoiding unnecessary expenditures of money at this time?

Is one-story construction cheaper than multiple? Cite projects to prove your answer.

What part will teachers, parents, or pupils have in the planning of new schools? Will just "plain citizens" have an opportunity to help in the planning?

Isn't $25,000 per classroom excessive?

What curriculum advantages or improvements may be expected from increased space? I have long believed that lower grade pupils have too long a day in school. If all children were on half day (four-hour sessions), wouldn't we, with efficient teachers, do a better job at less cost?

Prices are the highest they have been. Is now the time to build under such circumstances?

You state rooms must be large enough for activities, projects, etc. We didn't have these when we were in school and have made a successful living. Why do you say we *must* have them now?

A neighboring school sold its bonds for less than 2 per cent. How do bonding companies, etc. determine what they will pay?

What is the anticipated increase in assessed valuation, and what method have you used to determine this?

What is included in "cost per room"?

What will be the effect of continued increases in assessed valuation to the taxpayer over the years?

Isn't it true that any kind of school will decrease property values of those properties next to it?

Why is enrollment different from attendance? How can such figures be misleading?

Why have we not seen sketches of what the buildings will look like?

What are the purposes of a junior high school that make it different from the elementary school in the ordinary sense of the word?

How much district indebtedness exists now? What is the payment and interest schedule and the number of times and reasons for past refunding? What interest rates are we now paying on outstanding bonds?

Will the buildings be provided with automatic sprinkling devices?

Will taxpayers be asked to pay for such things as sound treatment, intercommunication systems, and other unessential equipment?

Couldn't we include a swimming pool in the proposed projects?

How can you ask for a cafeteria when dinner pails and sacks are still available?

Other projects have been built by volunteer labor. Could not the "fathers" build the small additions at a great savings to the taxpayers?

What figures on a unit basis do you have for the several kinds of heating methods (coal, gas, oil, etc.)? What have we decided on and why?

What are the arguments in favor of room toilets as compared to "gang" toilets?

Isn't it true that the birth rate will decrease somewhat and that we are now at our peak in elementary enrollment? Therefore, why not build temporary structures?

What is the proper size of an elementary classroom, and what criteria are used to determine this?

Why install fluorescent lights in elementary classrooms when filament is cheaper?

Why not blacktop *all* outside play areas rather than just parts of each play area?

Is it necessary to have showers, lockers, etc. for boys and girls of junior high age or lower?

Why build gymnasiums? On the elementary level there is no absolute requirement that play be in a gymnasium. The state recommendation can be met by other means, can't it?

What other communities in the area have passed bond referenda successfully or unsuccessfully? What was the size of the program and the bond issue?

What is the proper size of playground area and site according to enrollment?

Are present heating facilities in existing buildings adequate to carry an additional load?

Were present buildings designed for expansion (out or up)?

What are the legal requirements to vote?

Does the state or nation help finance new schools? Are there any other financial aids available?

Will all buildings be of the same quality and design?

Will all projects get under way at the same time?

Instead of building new schools, why not incorporate all as additions to existing schools?

Can we legally get rid of tuition students of long standing? Must we continue to take tuition pupils?

Would not the elimination of high school tuition students solve the problem of space? (Downers Grove has a separate high school and elementary district.)

What reasons can be advanced for the selection of sites as presented?

Does the total issue as presented represent all costs or just the costs of construction?

Will parochial pupils continue to be transported by public school busses?

Will bus service be increased for all pupils?

Will all children have cafeteria service?

Does the board own any property which it plans to use or sell?

What use of outside authorities has been made in planning the building program?

Who is paying the cost of promoting the campaign for more building facilities?

Headlines from the *Downers Grove Reporter* Showing Effective Public Relations in Community Participation in School Building Planning

October 20, 1949	"Drive to Obtain School Census to Start"
October 27, 1949	"School Census Mass Meeting Tuesday Night"
December 1, 1949	"Community Council Votes to Assist School Boards in Study of Expansion Program"
March 9, 1950	"School Building Program Committee to Release Findings"
April 13, 1950	"The A-B-C of Our School Situation"
	"First Facts and Figures as Revealed by Our Public School Census"
April 27, 1950	"School Board Sets May 20 for Bond Referendum"
	"Citizen's Committee to Canvass Village Prior to Election"
May 4, 1950	"Official Publication Notice of School Referendum: Page 2"
May 11, 1950	"Proposed New School Sites Located on Map" (map on front page showing locations)
May 18, 1950	"Give Our Kids a Break.... Vote 'Yes' on All Propositions" (full front page spread)
October 19, 1950	"Reporter Wins Illinois Press Award First for Community Service" (for *Downers Grove Reporter* issues of May 11 and 18, especially May 18)
May 24, 1951	"Public Meetings for Downers Grove Resident Volunteers for School Canvassing Work Called for Tonight, Friday"
June 7, 1951	"Reporter Recommends: Vote 'Yes' on Downers Grove School Tax Referenda" (full front page spread)
June 14, 1951	"School Tax Rate Propositions Win Sweeping Victories in Referenda Conducted by Boards of Education"

Questions

Question: Is there any reason why the participating group should not become a permanent functioning committee?

Answer: It is best to set up participation with definite objectives, and when these are accomplished the committee is through. When school projects are accomplished, other civic projects can be attempted. There should be a long-time program set up.

Question: What is the role of the superintendent in community participation?

Answer: He should supply the leadership and handle public relations. The program must be planned so that it will be self-propelled and not be dominated by the superintendent.

Question: How do you go about selecting the committee?

Answer: A committee makes a study to find out how many organizations are represented in the community. Each organization is asked to select someone from its organization to work on the committee. Representation is needed from various kinds of people and occupations. Select people with ability, with time to work, and with public confidence. Officially, the superintendent recommends and the school board sends the invitations to work on the committee.

Question: How much use is made of people who send their children to parochial schools?

Answer: It is important to have representation from all classes of people in order to avoid trouble from those left out.

Question: Did you bring the newspaper editor in on each program?

Answer: He wants people to read his paper, and he wants recognition for his paper. He must be education-minded to devote much space to the program.

Question: How much were pupils used in the planning?

Answer: Pupils made an important contribution by their comments to their parents and teachers. Pupil committees were used in projects, such as selecting color schemes for the rooms.

PRINCIPLES OF LAY PARTICIPATION IN SCHOOL BUILDING PLANNING

LAWRENCE H. SHEPOISER

The educational program of the school is determined for the most part by the character and quality of the community and reflects the thinking of the group which controls the policy making. This control may come from the strength of the community in terms of what is best, or it may come from the weakness of the community in terms of what is not good. Regardless of where the controls may be found, no school system or school building program will be any better than those who are in control want it to be. Because many people are not sure what good schools or good buildings look like, they are not sure what they want. When they are sure, they may not be satisfied with the kind that is now being provided by those who are in control of the schools.

To raise the sights of the community in general is one of the major responsibilities of those in charge of school administration. To accomplish this many superintendents have been searching for the formula which will make it possible to bring the resources, strengths, and talents in the community to bear upon the problem of developing better educational

programs and better educational buildings. There are those who do not want lay participation and who feel that they can secure good school building programs best when the board of education and the superintendent make their own decisions regardless of what others may feel and think. They feel they know what is best for the community or the child, and so they will decide. They sometimes have a rude awakening when the people are asked to vote for the bonds or for the membership on the boards. Sometimes they do succeed in getting the building they want, only to find that their building is outdated before the architect can give them the keys. Even if they are successful in getting a modern building which offers many educational opportunities, they find that the community may not appreciate it or is unwilling to support the kind of education that goes with such a building.

Why is it that in one community you may find a good educational program and modern buildings, while in a neighboring community with almost the identical financial capacity you may find poor buildings and a poor educational program? True, the first community is usually more prosperous and is a much better place in which to live, yet it has the same potentialities. Why do you see such glaring differences in communities throughout the nation? There must be something more basic than the professional competence of the superintendent or the architect.

The big difference, I feel, lies in the lay understanding of what makes a good school building, and how it can be obtained. What are the standards that you as superintendents or board members should be using in determining the kind of buildings you should be building for your community? Is it your standard of what a good building should be like, or is it the standard set by some controlling group in your community? It seems to me that the standard which you should be using in your own communities is the one which was given to us over 100 years ago, when Noah Webster wrote that "the whole power of education must be used to establish the goals in a community." Then there is the same standard so clearly stated about 50 years ago by John Dewey, who wrote that "what the best and wisest parent wants for his own child, that must the community want for all its children. Any other ideal for our school is narrow and unlovely; acted upon, it destroys our community." How can we know what the wisest and best parents want for their children unless we ask those parents to participate in the planning of the kind of a building which they would like to have and are willing to support for their own community?

Lay participation is not a new fad in our social order, it is only new to some schools. If we were to examine those communities closely which have powerful schools for education in American democracy and have established good public relations, I am sure that we will find that they have brought the community in on their planning. You will find that these communities have used these community groups as sounding boards for the ideas which they would like to see put into effect.

We all know that lay participation has been used in the business world to build up good public relations and to gain the support of the public for the kind of a product or program in which it is interested. The business man has been interested in the emotions, attitudes, and tastes of the public and has gone to great trouble to poll their opinions. Witness

the advertising and materials that large corporations are sending out to the stockholders. They attempt to make their stockholders feel they are a part of the corporation by asking them to make their suggestions as to how to improve their own company. You buy a new car today and within three months you will be sent a questionnaire by the company asking you to evaluate your car and make suggestions for improvements.

Why are these companies, which are in business mainly for the profit, so concerned with what the lay public thinks about their product? They know that they will get ideas from them that will make it possible to build a better product more suitable in serving the needs of the consumer. Just think for a moment about the changes which automobile manufacturers have brought about in meeting the needs of the owner because of the gripes or suggestions which the owners themselves have given. Realize for a moment who has benefitted from this participation. Has it not been both the manufacturer and the owner? Could not boards of education and lay citizens have the same results from mutual participation? Today many schools are attempting to discover new techniques for tapping the resources of the community for a richer and deeper participation. Those who are doing it believe that lay participation is an aid to improving the level of understanding of what good schools and good buildings look like. They have decided to utilize the intelligence and common sense of many people in a cooperative venture to better meet the needs of boys and girls in American democracy.

If you do not believe in lay participation, then for you the issue is closed. If, however, you feel that there is something to be gained through lay participation, there are a number of principles to which you should give attention. These principles have been developed by some of the people who have made a study of lay participation or practiced it in their own communities. As schools gain more experience in this field of human relations, the science of participation will be revised and refined. However, a word of caution should be given at this time. Experience has proved that what will work in one community is not always bound to work in another. Lay participation has to be community tailored. The superintendent and the board of education, however, have a great responsibility for the skills used in tailoring.

The first and basic principle concerns the philosophy of the superintendent of schools and the understanding of the board of education as to the purposes and procedures of lay participation. To begin with, the superintendent must see the schools as an essential part of the democratic process and must have an inborn faith in the purposes and procedures of democracy. He must evaluate his own philosophy in terms of what should be the implementations for lay participation. If he has not already developed democratic participation with the faculty and other school employees, he has little chance of seeing participation work with the lay public. Finally, he must believe that the lay citizens who are interested in the schools are capable of doing something worth-while which can contribute to the development of a good school program or to the planning of good school buildings.

When the superintendent is sure of his own thinking and his own philosophy, then he must help the board of education to orient its thinking and to develop principles for their own community. The board mem-

bers cannot accept the principles of the superintendent *per se*, but must think through the whole process themselves so that they in turn will know the implications. There is not much chance for a lasting and successful working relationship unless the board adopts the principles as a part of their working policies. It would be an unusual board indeed in which all the members would come to immediate agreement on lay participation. Some may feel that the lay group is just another form of a pressure group which would like to usurp the powers and prerogatives of the board. It is natural that they should feel like this, because that has been the nature of most groups which appear before the board. On the other hand you may be pleasantly surprised to find many boards are ahead of you in their thinking in regard to lay participation and have been wondering why the school has not made greater use of this means of building up good public relations.

The experience of most boards of education with which I have come in contact or have read about is that the more clearly they understand the power that lies in good participation in building support for the kind of schools they feel is best for the community, the more enthusiastic they become. In some schools where the experience has not been too successful, it has been because the superintendent has not clearly understood the problem and therefore everyone in general is in the dark as to what should be done. There is a greater chance for success if the principles are spelled out something like this:

We believe that the educational program developed cooperatively by all those who are interested and able, and interpreted to all those who are the followers in the community, will have the interest and support of the public in general.

We believe that educational planning is a type of social engineering which is sensitive to the desires, drives, attitudes, and opinions of the public and which utilizes the dreams, insights, and abilities of the "best and wisest" people in the community.

We believe that lay participation helps to keep the controls of the schools in the hands of the people where it rightfully belongs in a democracy.

We believe that lay participation will help the school to identify some of the unmet needs of the child and community.

We believe that the interest, abilities, and understandings of lay citizens, along with the professional staff of the school, should be utilized in solving many of the specific and pressing problems now facing school administration.

We believe that lay participation is a necessary social counter-action against those few vociferous groups which are not in favor of the recognized purposes of public education in an American democracy and are unwilling to support them.

We believe that it is the responsibility of the board of education to establish lines of communication with all the publics of the community, so that the democratic processes may be allowed to function in determining the basis for sound policymaking on the part of the board of education.

We believe that lay participation does not usurp the powers and prerogatives of the board of education or take away their legal or moral

right to make the final decision after all the facts have been brought to bear upon the solution of the problem.

After the board has adopted the policies under which it wishes to operate, it must take the second step, which is to establish a channel through which the contributions of the people may be secured. The board should see that there is established a comfortable interaction between the school and community. The school should make the contacts with the various groups in the community in addition to individual citizens and the public in general. There must be a feeling on the part of the individual citizens that, when they are asked to express their opinions, those opinions will receive welcome consideration. These channels must not be a one-way street, where the public is only to listen to publicity about the schools, but one where the board will listen to the ideas and will defer action until all the facts are in. How these channels will be set up will depend entirely upon the individual differences of the community and the way in which it is organized for communication.

The second fundamental principle or prerequisite to good lay participation is that the superintendent must understand what is meant by the term "public." He must realize that the community is not just one public but is made up of many publics. The fact that each community is made up of numerous groups, each organized for a special interest and identifiable as such, is basic information which the superintendent must have when he is trying to secure the opinions and support of the community in general.

In our own community of some 30,000 people we were able to identify over 280 organizations, all of which have their own leaders, opinions, attitudes, and prejudices toward the school or any community issue. We must realize that there are as many opinions as there are groups, all of which are colored somewhat by the special interest for which they were organized. If the school wishes to be a true expression of the best that there is in the culture of the community and to reflect the best and highest aims and ambitions of the people it serves, to say nothing about meeting the needs, then it must be able to get this cross-section expression of its public. This can be done best when those groups have been identified and the resources and talents of the best that each of these groups can offer have been tapped.

The third principle has to do with the method of selecting the citizens who are asked to serve. Here we find a great deal of difference in techniques and procedures. Ideally, perhaps, the citizens should select their own representation. However, this requires a technical knowledge of the composition of the community and an insight into the nature of the problem, along with a good understanding of human nature, to assure having a committee that has the necessary interest and ability and yet is representative of the community. That is why we use the procedure of having the superintendent make the selection with suggestions from key people who have no ax to grind. Then the superintendent makes the recommendation to the board of education, which in turn makes the official selection. I am not sure that this is the best way or that there is anyone who knows what is the best way. The central advisory committee selected by the board broke itself into many subcommittees and gave a chance for many organizations to elect or appoint their own representatives. This

committee was expanded until approximately 1,000 citizens had some form of participation. Of course it was not all on the same plane or of the same value. I think, however, that it is most important that the superintendent and the board make a decision before they approach the problem as to how they will work it out in their own community. A lot will depend upon the composition of the community and the experiences which the various groups have had in participation. One thing is certain—competent leaders will come to the front as well as good ideas, regardless of the procedure, just so long as the methods fit the temperament of the people.

The fourth principle would seem quite obvious, yet it is often neglected. It is simply that the superintendent should clearly understand what he wants the public to do. There is no quicker way to have confusion or to have the lay group go off on a tangent or lose interest than for the superintendent to be unable to state and define clearly to the group the problem with which it is to work. Even when the group gets to working on the problem, they may become so interested in some of the unmet needs of the community that they will need to be reminded of the problem at hand. It may be well for the superintendent to follow the work of the committee quite closely and check on the progress from time to time. However, extreme care must be used that the superintendent does not dominate the thinking of the group and drive them to the conclusion which he hopes they will reach. He should let them understand that it is their ideas he is after and that if they wish to make a supplemental report on other issues as they see them they should be free to do so. The report which the committee makes should be pertinent to the issues involved.

The fifth principle is a corollary to the fourth. The people must know why they are wanted and what they are expected to do. If this is not clearly understood, then the superintendent and the citizens may work on opposite ends of the rope. Lay participation must be a cooperative venture on the part of the board of education, administration, teachers, and the lay public. The *esprit de corps* must be such that the superintendent and the board of education will realize that it does not have a monopoly on all the good ideas and the lay citizens will realize that not all their ideas are so good that they have to be accepted and put into practice at once.

The sixth principle has to do with initiating the program of participation. This should be begun with a special problem and set up according to a time schedule, so that everyone will know when they are to begin and when they are to end. The problem we used in our community to start off our program was that of evaluating our school buildings in terms of the kind of an educational program we would like to see developed in our community. The board of education sent a letter to each of the 15 citizens who were asked to serve on the central committee. When they first met they were given the purpose and provided with an outline of the problem. Then they elected their officers and proceeded to break down the problem as suggested in the outline. They organized themselves into subcommittees and proceeded to enlarge their committees so as to be able to cope with the magnitude and scope of the problem. For instance, one of the committees had to evaluate the buildings as to adequacy of the educational program and as to capacity as well as structural features. This

committee was enlarged to include some 150 people. They were given one afternoon and evening of instruction concerning good buildings and then were given score cards to use in evaluating and reporting on the various buildings. You may question the ability of the citizens to do this supposedly technical work. When the evaluations were turned in, there was a surprising correlation between their scores and those of the professional people who scored the same buildings. In general, the lay citizen was more critical of the building than were the professional people.

There are many problems in which you can have lay participation. Laymen may work on the curriculum of the school in helping to decide the scope and breadth of your educational program. They may help you settle the question of class size or the kind and number of services which your school should offer. Again, they may help in gathering the pertinent data which must be gathered in making the decision for a new site. These are some of the important decisions which the board and superintendent have to make before they can present to the architect the educational program for which he is to design a school building.

The seventh principle is that the board of education should determine in general the type and kind of a report which it will want the committee to make. If an extensive study is to be made, in which there has to be a lot of research, the board must determine the budget under which it can operate. It must also decide what consulting services, if any, it is going to provide. In our case the board decided that it would employ the consulting services from two universities. A lot will depend upon the nature of the problem and the extent of the study.

The eighth principle is that the board should not put the report on the shelf to collect dust, nor should it make decisions regarding the problem which precedes the report. The report should be studied carefully by each member of the board and then the board as a whole should make its evaluation report back to the committee. If there is disagreement, the board should give its reasons. Last but not least, the board should send a letter of appreciation to the members of the committee for the services which they have given.

The ninth and final principle is that the board should use the report only as a basis for making its own decision in regard to the solution of the problem. In no case should the board accept the report just because it is made by the citizens' group any more than it should accept the recommendation of any citizen *per se*. It is very important that this last principle be observed in order that the proper relationships be maintained between the board and the citizens, and that the legal and responsible position of the board be maintained in the eyes of the public. The board of education is the legal representation of the people and is responsible to the people for making the decisions which determine the policies of the school.

In summary I would say that the values of lay participation seem to be that it:

1. Promotes understanding and therefore support for good schools
2. Develops good public relations
3. Gives the board of education a true sounding board
4. Brings the school and community closer together

5. Brings the schools closer to the people
6. Helps the public to understand what good schools look like and what they can do
7. Permits the board to avail itself of all the expert knowledge in the community
8. Improves the program of the school
9. Develops leadership and good citizenship for a democracy
10. Permits schools to operate in a democratic fashion
11. Builds group spirit which takes away the cliques
12. Permits an outlet for individual and group expression
13. Helps to identify the unmet needs of the community
14. Establishes confidence in the schools
15. Rallies support when needed to meet a crisis
16. Permits the community to grow up democratically

PAINTING FLOORS

BAIRD K. EATON

With the possible exception of painting metal, no other painting problem can exasperate the manufacturer, as well as the ultimate user, as much as the problem of painting floors. There are about 2,500 paint manufacturers and roughly 20 times that number of various brands of floor paint on the market. Even with this wide choice at hand, one is still justified in asking: "Which paint will be best for my floors, and how long will it last?"

There are some very encouraging signs in the wind which will, in time, minimize the problem of painting floors. Synthetic resins, which after the war were going to answer all our problems, are finally settling down in their proper places.

There are today many types of synthetic resins suitable for paint manufacture. Some of these can be used in combination with others, and research and experimentation is going on constantly. Of the most popular new resins now becoming familiar to the paint user are phenolics, vinyls, turpenes, soy bean, and hundreds of copolymers of synthetic rubber, styrene, butadene, etc. Tests have proved that floor paints made with vinyls and some of the phenolics, particularly those formulated so as to allow curing to take place by catalytic action rather than by evaporation, last many, many times over those we commonly refer to as floor and deck enamel. However, a good many of these curing finishes have a low flash point and contain dangerous agents such as xylol. These highly dangerous and combustible materials have no place in our schools and universities.

Not only are some of these synthetics dangerous to handle, but they require special preparation and careful application. An industrial plant might be persuaded to try an entirely new and revolutionary method for applying floor paint, but it is rather difficult to ask further time from the custodian or maintenance man other than to "stir and apply."

Further experimentation on synthetic resins will prove that a com-

promise can be made and that a relatively safe material, simple in preparation and application, will provide good adhesion to the floor and offer excellent wear to traffic.

It is, of course, advisable to check your paint to make sure that that particular paint is suitable for the kind of floor you wish to finish. Some paints are manufactured for special surfaces, while others can be applied to almost any type surface. It can never be stressed too strongly that the complete directions should be read before preparing to do the job.

Painting a concrete floor or other masonry surface presents a problem all its own. For many years after pouring, concrete retains a lot of moisture which dissolves the alkali in the cement. The alkali then reacts with oil base paints, resulting in premature film failure due to loss in adhesion, which in turn leads to scaling and peeling. This reaction is called saponification. Therefore, a concrete floor must be neutralized or conditioned prior to painting with an oil base paint.

The application of a zinc sulfate solution can be used to neutralize the alkali condition. A concentration of three pounds of zinc sulfate to a pail of hot water has proved effective. Magnesium silocofluoride can also be used, one pound per pail of water. In both cases, the concrete surface is washed with either one of these solutions and, when dry, the excess crystals should be swept up. New concrete should set properly and be allowed to dry to a normal moisture content before any painting is attempted. Sixty days is the normal setting time. It is, of course, advisable to have the floor as dry as possible. Painting should be postponed if the relative humidity is over 65 per cent.

In painting concrete, as in painting other types of floors, the first coat should be thinned with a suitable thinner in order to assure penetration, which results in good paint anchorage. The second and succeeding coats should be applied from the can without dilution. Better results can be obtained if all coats are thin coats and if a final drying period of at least 24 hours is allowed prior to foot traffic. Regular oil base paint does a fair job on concrete floors. A phenolic resin type of paint will give better service under heavy foot traffic and is particularly adapted to areas where petroleum products are being used. The synthetic rubber base paints are particularly suited for concrete floors, especially those that contain no oil at all, because the rubber will not saponify on contact with alkali, which means almost positive assurance against film failure by loss in adhesion. The synthetic rubber base floor paints dry quicker and give a real tough elastic film.

Wood floors do not, of course, present the chemical problem that concrete floors present. Old paint should be removed if it is in poor condition or if a change in the type of finish is desired. For clear finishes, badly stained spots may be removed with oxalic acid dissolved in hot water. This bleaching solution should be left on the floor until the stains disappear. After proper preparation and thorough cleaning of the floor, two or more thin coats of varnish may be applied. Again, in the case of clear finishes, a rapidly growing method of finishing floors consists of using a wood sealer and paste wax. The sealer has the ability to penetrate into the fibers of the wood. Two thin coats are normally sufficient, followed by an equal number of coats of wax. This type finish is especially suited for gymnasium and auditorium floors and other large areas

subject to heavy foot traffic. The opaque floor finishes are usually based on the phenolic type vehicle, because of their abrasion resistance and toughness. Here again, the synthetic rubber base floor paints have proved very outstanding because of their good adhesion, toughness, and elasticity.

In the painting of steel or metal floors, the most important thing is proper surface preparation. In order for a paint to adhere well, the surface must be wire-brushed and cleaned of all rust, scale, and loose paint. A metal primer, such as red lead or preferably zinc chromate, should be used prior to the finish coat. For best results, the finish coat should be similar in composition to the primer, so that a good bond is insured. Normal failure is by peeling and flaking, which is due to improper surface preparation and primer coat application. The primer should be chosen for its rust inhibitive and adhesive qualities, while the finish coat is chosen for its adhesiveness and resistance to wear under traffic.

It might be well to point out here that some floor paints are available now with varying grains of abrasive mixed right into the paint. Tests have shown that these floor paints with abrasive particles afford a better bond with the surface to be painted, increase the paint film's resistance to wear, and provide an almost non-slip surface for traffic.

Since linoleum is either waxed at the factory or while in use, it must be cleaned in order for the new finish to adhere. Turpentine or gasoline may be used, although the latter presents a hazard. A coarse cloth will work well in removing the old wax. The linoleum should be washed again with hot water and household ammonia and then wiped dry and allowed to stand several hours before painting. In applying the paint finish, little pressure should be used and the finish should be applied quickly with a fully loaded brush. Work should not be gone over. In almost all cases of floor painting, three thin coats are better than two heavier coats. Thin coats insure proper drying which in turn means more lasting results.

Painting of such surfaces as rubber and asphalt tile is not advised. The solvent action of the paint may cause the dissolution of the coloring matter in the asphalt rubber itself, resulting in streaks on the surface of the finish coat. This bleeding may be avoided by using certain types of emulsion primers and sealers which dry quickly. The finish coat in such an instance should contain a low-powered solvent in order to avoid lifting of the primer coat.

Film failure on painted floors is not always the result of heavy traffic. It can be directly traced to misapplication. Non-uniformity in color and gloss may be the result of poor application of primer and sealer. Varying degrees of penetration can cause apparent difference in color.

As sold today, ready mixed paints do not need the addition of any material such as oil, dryer, or thinner. Additions of any of these materials may result in prolonged drying time in the case of oil addition and possible wrinkling in the case of dryer additions. Thinner should be used only when necessary and then only the proper type should be used. Thinning instructions are usually on the label of every can. Thick applications of paint lead to abnormal film formation, since complete drying is not attained. In the case of a thick film, drying occurs more quickly on the surface, which prevents the volatile thinner beneath the surface from

escaping. This results in blisters and a soft film, easily marked. Blistering and peeling can result if painting is done during a period of high humidity or when temperatures are below 40 degrees.

To summarize briefly, care should be taken in the proper preparation of the surface to be painted. The paint should be selected for the particular purpose in mind, and the instructions on the label should be followed closely. Several thin coats are better than one or two heavy coats. Painting should be done on a day when the temperature and humidity are best for the work. Painting should not be done on cold or wet surfaces. Sufficient drying time should be allowed between coats, even more time than the minimum requirements stated on the label, if possible. A good brush should be used and the paint should be well mixed before painting.

Too much stress cannot be placed on the importance of proper application in order to achieve the best results.

FLOOR COVERINGS

W. L. JOHNS

On behalf of the Armstrong Cork Company, we want to thank you for the opportunity of meeting with you today. We know that you don't want to listen to a sales story. You are seeking information that can be of help to you in your profession. This is exactly what we propose to give you—a factual story about our floor and wall products, what they will and will not do, their relative prices, and some of the special problems connected with their specification and installation. [Unfortunately, we are unable to include the many fine slides used in this talk.]

We make many basic floorings. Since we make all types of resilient floors, we are going to talk frankly, pulling no punches, about the relative merits of the different types of floors and where we think each is the best floor.

The basic resilient flooring types are linoleum, Linotile, cork tile, asphalt tile, and rubber tile. Linoleum is offered in both roll and tile form. Most of these products are plastics, either of the thermoset or thermoplastic nature. We have not elected to call any one product a plastic floor. Several of the products are made from synthetic resins; however, we have not associated the name of any product with any of the "magic" resins which have been so highly publicized in the last few years.

In choosing a floor for a particular installation the thoughts that probably run through your minds are these: Will it withstand conditions to which it will be subjected? What is the decorative value of the material? Will the floor meet my cost budget? Is it readily available?

Let's talk first about a few flooring problems and see how they affect the choice of flooring materials for a particular job.

Here is a condition that restricts the use of resilient flooring materials—a concrete slab in direct contact with the ground. We recommend only asphalt tile for installation on concrete slabs below grade. Asphalt tile and rubber tile are the only products of our manufacture which will

withstand the attacks of alkaline moisture usually present in concrete subfloors in direct contact with the ground.

When a resilient floor is laid on a concrete slab in direct contact with the ground, the moisture in the ground works its way through the concrete, dissolving the free alkali in the slab.

When the slab is not covered, this alkaline moisture usually evaporates, and often the slab appears to be absolutely dry. But when you seal in that moisture by putting something over it, troubles start unless the flooring and the adhesive chosen can stand the attacks of this strong solution. With tile the moisture usually accumulates under each tile, some of it passing out through the seam between tiles. Three things can happen. The alkaline moisture can destroy the effectiveness of the adhesive. Or the moisture may penetrate the back of the material, producing discoloration on the face of the tile. Or it might pass through the seams and evaporate at that point.

With floors that lack resistance to alkali this evaporation at the seams often produces discoloration around the edges of each tile.

Linoleum and Linotile are especially vulnerable to alkali because they are made basically from linseed oil. The alkali goes to work on the oil binder, and pretty soon the material tends to become brittle or discolored, or the bond is broken between the material and the floor.

Frequently we have been asked for methods of waterproofing these floors so that linoleum and other resilient floors can be installed. We have experimented with many waterproofing agents, most of which worked for a short period of time but eventually gave way to moisture passing through the slab.

The most satisfactory means that we know of that is practical from a cost point of view is membrane waterproofing, which can be done in several ways. A concrete slab is poured, then a membrane of felt layers is applied, then a slab is poured on top of that.

Best results seem to be obtained where three to five layers of felt, mopped in hot asphalt or pitch, are applied at right angles to each other. These treated felt layers are flashed up the wall to form a seal at the juncture of the floor and wall. Even though these precautions are followed, there is occasional trouble with membrane waterproofing. It is not a foolproof method.

To summarize, completely waterproofing a floor at a reasonable cost is difficult. A good percentage of the installations of resilient flooring over membrane flooring are satisfactory, but the number of waterproofing failures that do occur cause us to lean toward using rubber tile or asphalt tile on grade level concrete subfloors and asphalt tile only on below grade concrete subfloors.

Perhaps you have run into the problem of which flooring material to specify on a radiant heated floor. Let's talk about that for a few minutes.

For some years we have been conducting laboratory and field tests of our products on radiant heated floors. Generally these tests show that no excessive drying out or hardening occurs, and no appreciable softening results from the direct heat. As a matter of fact, radiant heating does not cause any resilient flooring problems, so long as these precautions are followed. General floor temperatures should not exceed 85°, and

water temperature in heating pipes should not exceed 120° F. Heats greater than this are usually uncomfortable underfoot, and they cause asphalt tile to indent easily. In some instances, the bonding strength of adhesives is impaired.

Large pipes placed at wide intervals often produce too great a heat concentration for resilient floors. The areas right over the pipes get too hot. The general practice of using one-inch pipes laid at one-foot intervals presents no problems so far as resilient floors are concerned; you can specify materials for that kind of radiant heated floors just as though radiant heat was not involved.

If you have projects involving resilient flooring, where the radiant heating system does not conform to the pipe sizes and intervals mentioned, it would be well to get the manufacturer's recommendations before choosing a floor. We are always glad to talk over these special problems with you.

On grade and below-grade slabs the alkaline moisture problem is still there, even though heat pipes may run through the slab. On radiant heated floors on direct slabs, we strongly suggest that you use floors that are not affected by alkaline moisture. For suspended floors, go ahead and use what you would if no radiant heat was employed in the floor.

The amount of heat that will pass through a flooring material is important when working with radiant heated floors. Rubber tile is the best conductor, then asphalt tile, then Linotile, then linoleum, and, last, cork tile. All of these floors are entirely satisfactory for use on radiant-heated floors.

As you probably know, there is a big difference in the oil and grease resistance of different floors. Few installations would involve concentrated doses of grease, but in restaurants there is food spillage, in machine shops there are lubricating oils, in automobile showrooms there is dripping oil from automobiles, in kitchens oils and greases are spilled and there are splatters from skillets and a greasy residue that settles on the floor as a result of cooking foods in oils and greases.

Standard asphalt tile and cork tile have the least resistance to vegetable oils and greases. Linotile, linoleum, and greaseproof asphalt tile have the greatest resistance. In the case of standard asphalt tile, oil and grease left standing for any length of time tend to soften the material sometimes to the point where it is easily indented or discolored. Frequently the tile becomes so soft that the top of the mixture can be tracked away on the shoes of a person walking on it.

Cork tile, because of its rather porous nature, tends to absorb oil and grease to a greater extent than do some other flooring materials, and it will spot where oil and grease are spilled. Naturally, a heavy coat of wax on a cork tile floor will minimize this; however, if oils and greases are present you are safer in using a floor that has satisfactory resistance characteristics.

Greaseproof asphalt tile has the same alkali resistance as standard asphalt tile; but neither greases nor vegetable oils nor mineral oils will harm it. This type is slightly more expensive than the standard asphalt tile.

Rubber tile is not the best floor to recommend where oils and greases are prevalent. It has only fair resistance.

Linotile, linoleum, and greaseproof asphalt tile all have excellent oil and grease resistance characteristics. If there will be an appreciable amount of oils and greases on a floor, it would be our suggestion that you give first consideration to either Linotile, linoleum, or greaseproof asphalt tile.

You have seen floors with large indentations. Chairs and furniture which have rested upon them have indented the flooring material. Indentation can spoil the appearance of a beautiful job, and the indentation can occur the day the material is installed. Some floors will stand far more static load than others. Since there is a big variation in the indentation resistance of different resilient floors, it is very important to choose the flooring that best fits the conditions to which the floor will be subjected.

Linotile and rubber tile, with an indentation resistance of 200 pounds static load per square inch, have the greatest indentation resistance; approximately eight times that of linoleum. This is very important when static load is a flooring problem.

One of the greatest offenders is chair legs which so often are not properly protected.

We strongly recommend these precautions: First, choose a floor that best fits the indentation requirements for the area in which it will be used; and second, insist that furniture to be used be equipped with proper furniture rests of the right type and size.

There is another consideration that influences the choice of a resilient floor. That factor is quietness. In libraries, hospitals, and similar types of buildings, noise must be kept to a minimum.

Of the Armstrong resilient floors, cork tile makes the least amount of noise at the point of impact. Rubber tile runs a close second. Linotile is next, then linoleum, with asphalt tile at the bottom.

Incidentally, the resilience of a floor, or its cushion effect underfoot, is closely related to the noise factor. The cushion underfoot that a resilient floor contributes is very important on many installations. Nurses, teachers, banktellers, dentists, sales clerks, all appreciate the most resilient and comfortable underfoot. So far as comfort underfoot is concerned, we would rate cork tile and rubber tile right at the top, then linoleum, then Linotile, with the asphalt tile at the bottom.

Some floors are easier to maintain than others. Often a floor of low initial cost may be more expensive over the long haul than a floor of higher initial cost that is easier to maintain. This long-range cost factor should be seriously considered, since most resilient floors are expected to wear 10 or more years.

Linotile heads the list as the flooring that is by all odds easiest to keep. Linoleum is a good second. Asphalt tile and rubber tile are comparable in this respect, slightly below linoleum. Cork tile requires the greatest amount of maintenance attention.

Linotile has the inside track for floors of lobbies, entrance ways, corridors, and other areas where heavy traffic, wet gritty feet, or spilled liquids are involved.

From the standpoint of durability, Linotile again is at the head of the list. It is generally conceded to be our longest wearing floor. How

long a floor will wear depends on so many variables that it is not practical to rate the different floors 1, 2, 3. Judging from our own tests in the laboratory and in the field, and from the jobs that have been down for 15 years and more, it has been our experience that Linotile wears longest.

There are other comparisons of floors that might be made, such as insulation value, slipperiness, and the tile *versus* roll-type flooring. As we see it, these fall in the category of hairsplitting. There are points for and against each product, and they are all hard to prove. We think they are pretty much a matter of opinion.

Now let's talk about decorative possibilities for a few minutes. We would like to point out which types of floors lend themselves to what kinds of floor treatments.

For geometric floor designs, such as a hollow square layout, tile is a natural because the design can be formed from individual tiles. Linoleum rolls are six feet wide, so producing this type of design from linoleum would involve a lot of cutting and inserting, which is expensive to perform.

Where long sweeping curves are desired, linoleum is the easiest floor to install. One strip of linoleum is lapped over the adjacent strip; and the mechanic cuts the design through both strips at the same time. This type of design can be produced in tile form, but it is more difficult and consequently more expensive for the custom work.

On a criss-cross lobby layout, either roll-type material or tile could be used and the choice would be immaterial. The rolls can easily be cut into strips, or these strips can easily be formed with individual tiles.

From a decorative and maintenance point of view, there is one advantage that linoleum can claim over tile. Linoleum can be flashed up the wall to form what is called flash cove base. This treatment gives a nice finishing touch to a floor, and it provides a streamlined juncture between the floor and wall. This streamlining is particularly desirable in hospitals where the sanitary angle is paramount.

A top-set cove base can be made of rubber or asphalt. Four-foot lengths of this material are connected to the wall, the cove resting on top of the flooring. The bottom edge of the tile feathers out to form an easy-to-clean juncture.

Top-set cove base involves less labor in installation and is considerably less expensive. A wide choice of colors is available in top-set cove base.

Unquestionably cost is a vital consideration on a good proportion of your jobs. We wish we could give you today a price list showing exactly what each floor costs installed. This is not practical, because local circumstances, labor conditions, and job conditions cause prices to vary a great deal. However, we do want to give you the relative prices and the general cost bracket.

Generally speaking, asphalt tile and light gauge linoleum are the lowest in price. In the next cost range are greaseproof asphalt tile and standard gauge linoleum. Then comes 1/8″ gauge linoleum. Rubber tile, Linotile, and cork tile cost roughly the same.

If you were to judge the floors by price alone, asphalt tile, and light

gauge linoleum would be used on most of your jobs. Probably you have clients who are more interested in first cost than in ultimate cost. We think you do those customers a real service when you use the best floor, all conditions considered, letting ultimate cost and suitability for the job be the criterion rather than lowest initial cost.

Here are the gauges of materials now offered. In linoleum there are three gauges: light, standard, and heavy. In rubber and asphalt tiles there are two gauges, 1/8" and 3/16".

Perhaps some of you wonder why there is no 3/16" gauge linoleum and Linotile. We no longer manufacture gauges heavier than 1/8" in the case of linoleum and Linotile, simply because we do not think heavier gauges are as good and economical a buy. With finer ingredients and improved methods of manufacture, the 1/8" linoleum that is being made today will wear just about as well as the old 3/16" gauge linoleum. It is rare, indeed, when we see a piece of 1/8" linoleum worn out. It is so rare we do not feel justified in making a heavier gauge, which would in most cases result in the customer's buying more wearing surface than he needs.

There is no getting around it, every flooring product has advantages and disadvantages. We have not come up with a floor that will fill all of the requirements we've discussed, nor has anyone else so far as we know. We would be kidding ourselves and our customers if we presented any one floor as being ideal for all types of installations, but we think we are better advised to offer a range of types from which the best floor for a specific installation can be chosen.

Suppose a hospital project requires resilient flooring for a third-floor children's ward. What would you use? Quietness is desirable. High resistance to indentation is also sought, since castered beds and other heavy wheeled equipment will roll over it. A bright cheerful floor has been requested.

Rubber tile was chosen for this kind of a ward in the Korsair Crippled Children's Hospital, Louisville, Kentucky. It is quiet, has great resistance to indentation, and makes a colorful floor. Incidentally, the figures cut in the floor brighten the atmosphere of this ward. Heavy linoleum also makes an exceptionally fine floor for hospitals because it can be flashed up the walls, providing a streamlined, easy-to-clean juncture between floor and wall. Too, it is an easy floor to maintain.

What would you do with a basement library? Quietness and indentation resistance are needed, but the most important consideration is that the floor is below grade. Asphalt tile would be our choice. It is the only floor that can be safely recommended for floors below grade in direct contact with the ground.

The Jahrans Braun Department Store, Buffalo, New York, selected Linotile for their main floor because of its superior wearing qualities and ease of maintenance.

For industrial floors nothing decorative is needed. What is needed is a non-dusting, non-sparking floor that can take the loads imposed by fork lift trucks and other rolling equipment. Industrial asphalt tile was developed especially for this use. It is an inexpensive, long-wearing floor. There is a conductive asphalt tile available, too, for use where explosion hazards exist.

For the corridors in our own executive suite in Lancaster, Pennsylvania, we selected rubber tile because of the color richness and the feeling of dignity that this product imparts.

Many gymnasiums have been done in asphalt tile. One in particular is the Cannon College Gymnasium in Erie, Pennsylvania.

Linoleum was used with good results in the corridors of the June Adams Junior High School, Seattle, Washington. It wears extremely well and is easily maintained.

The library of the Korsair Crippled Children's Hospital in Louisville was done in rubber tile. Cork tile also makes a fine floor for libraries.

For the lobby in our own auditorium at the home office we picked Linotile. This floor receives heavy traffic. Too, it is a showplace and must look good at all times. Since Linotile is such a long-wearing floor and is so easy to keep, it was our choice.

Every area is an individual problem. No one flooring type fills every need. The safest specification is the resilient floor that is tailor-made for the specific area being considered.

So much for floors. I should like to talk about wall covering for just a couple of minutes. The least expensive wall covering we make is Armstrong's Quaker Wall Covering. It comes in rolls 54" wide and is cemented to the wall. It is used extensively in low-cost housing projects and in building renovations.

Of far greater interest to you is Linowall, which was used in the Julienne High School, Dayton, Ohio. This material is a linoleum-like product made in roll form, either 3' or 6' wide. It is cemented to the wall. It makes a fine wall for corridors of large buildings, since it is easy to keep clean, is hard to scratch or mar, and is a highly decorative material.

Linowall may be used in a reception room. The fact that it can be washed over and over again makes it a practical permanent wall for offices or areas like this where city smoke presents maintenance problems. Decorative possibilities are unlimited with this material. Almost any design can be cut in Linowall.

This material is a popular wall for kitchens because of the ease of maintenance. It does not chip, crack, or craze, and it can be bent around the corners to produce streamlined, easily cleaned corners.

Linowall costs about 2½ times as much as Quaker Wall Covering installed. Neither of these products should be used in stall showers or recessed tub areas. They just will not stand the moisture conditions that prevail there.

We cannot blame you if you are a bit bewildered, since we talked about so many different floor and wall materials and so many factors that affect each type. If you desire specifications, samples, or more information concerning any of the material shown, we shall gladly furnish it for you. It has been a pleasure to meet with you and to present our product story to you.

Questions

Question: Of what materials is the base trim made?

Answer: The top-set is already formed. It is usually made of rubber or asphalt.

Question: Distinguish between linoleum and Linotile.

Answer: Linotile does not have a felt backing. It has ⅛" of wearing surface.

Question: Are these floor coverings resistant to acids?

Answer: They would withstand the normal acids in an elementary school laboratory. They would not withstand concentrated acids.

Question: Isn't asphalt tile, when used on a gymnasium floor, harder on the feet?

Answer: Yes, I believe it is.

Question: What is the relative cost of asphalt tile as compared to wood flooring?

Answer: Asphalt tile costs from $.25 to $.30 per square foot installed, while wood costs about $1.00 per square foot.

RESILIENT FLOORING

V. F. KOPP

Since the Sloane-Blabon Corporation's products are somewhat similar in nature to those of the Armstrong Cork Company, it would be useless for me to go into a discussion of these products again. My company manufactures all types of resilient flooring. However, I believe we go farther with our Koroseal tile, which is a plastic tile. This product is exclusive with Sloane-Blabon in the flooring world. We believe Koroseal is the best type of resilient flooring when used for the purpose for which it was designed. Koroseal comes in 20 colors, in each of two distinctive surface finishes. Due to its long wearing quality, Koroseal is very effective for industrial and commercial usage.

The method of installing Koroseal is the same as that for any other resilient flooring. When Koroseal is installed by technicians other than from our company, we require the use of the adhesive we have developed especially for Koroseal. It is sticky in nature and always remains soft. Koroseal may be installed without felt padding on all types of floors. However, we recommend the use of felt on tongue and groove wood flooring. The felt should be laid at right angles with the boards. Also, we do not recommend the use of Koroseal below grade, but it may be used on grade and above.

We are very proud of the wear test of Koroseal. We find it wears 10 times longer than ⅛" linoleum and three times longer than rubber tile. Our laboratory tests tell us the indention factor of Koroseal is one half of 1 per cent under sustained pressure. This is almost negligible.

Koroseal is very easy to maintain. It is factory waxed. You can clean it with neutral soap, rinsing thoroughly. Buffing will take care of minor stains and scratches. Then, if a glossy finish is desirable, it should be waxed. Cigarette burns may be removed easily with steel wool, soap, and water.

Koroseal has been on the market from 2½ to 4 years. It is used in the City Service Oil Company's offices and laboratories. It is used a

great deal in banks, hotel lobbies, and other places where foot traffic is heavy.

Questions

Question: What is the cost of Koroseal?

Answer: When large quantities are purchased, the price is about $1.15 to to $1.20 per square foot installed.

Question: Is this product used in gyms?

Answer: No.

Question: Is it slippery?

Answer: No. No more than Linotile.

Question: What about its acid-resistant qualities?

Answer: It isn't the cure-all for all acids. It will withstand many acids. A dulling of the surface color may occur, but the composition of the product will not be hurt.

Question: How well will it withstand heat?

Answer: Temperatures up to 140° F. will not harm it from foot traffic, nor will temperatures down to —35° F. if it is not flexed.

SCHOOL FLOORS OF NORTHERN HARD MAPLE

J. B. ALBEE

During the past five decades, northern flooring manufacturers have produced over four billion feet of northern hard maple flooring. This is enough to "pave" six super-highways like the Pennsylvania Turnpike from New York to San Francisco, or to provide a 24-foot roller skating track around the earth at the equator one and a third times!

Yet our historical files tell us that 50 years ago at least one producer was giving away maple flooring throughout the Northwest in order to introduce it. The industry has indeed gone a long way since the early days. The northern hardwood flooring producers are now looking forward to making strides in the next 50 years that will compare well with their progress in the 50 years just concluded.

Northern hard maple offers a wide range of uses. It is close grained, hard fibered, and free from splintering, and it polishes under friction in a way which increases its wearing qualities. Maple is clean and sanitary, since the closeness of its grain and the smoothness of its surface affords no lodging place for germ-laden dirt. All pieces of hard maple are accurately side-matched and end-matched. This assures virtually a one-piece floor of hardest wood.

Due to its leadership in wearing qualities, northern hard maple flooring has sometimes been stressed for service uses, to the exclusion of any consideration of its beauty. Actually, maple is ideal for classroom and gymnasium floors, and it has been popular for these spaces for many years. Finished naturally, with a good penetrating floor sealer, floors of

maple reflect a mirror-like luster and require a minimum of maintenance and upkeep.

Northern hard maple flooring is scientifically kiln-dried, sold in standard grades, and described as to grade interpretation in an official grading rules booklet. This booklet, available free to the general public, also contains the standard thicknesses and face widths of flooring and other technical information.

Standard lengths, 25/32″ and thicker, and recommended grade uses for schools and colleges are as follows:

1. First grade—2′ to 16′ may contain up to 25 per cent of 2′ to 3½′, inclusive. This is the highest standard grade—an extremely durable and desirable floor for any building.

2. Second grade—1½′ to 16′ may contain up to 40 per cent of 1½′ to 3½′, inclusive. Second grade maple flooring will provide the same long life and low upkeep performance as first grade. Thus, it is a splendid choice for classrooms, gymnasiums, shops, cafeterias, and other spaces in schools, colleges, and institutions.

3. Combination grades—the second-and-better grade conforms to standard lengths established for second grade.

The standard measurement of northern hardwood flooring is sometimes misunderstood. For the record, flooring 1/2″ and thicker, all faces, is measured 3/4″ waste for matching. Flooring 3/8″ (11/32″) thick, all faces, is measured 1/2″ waste for matching. Jointed flooring, all thicknesses and faces, is measured 3/4″ waste.

Northern hard maple is also used in the manufacture of block and patterned flooring. The patterns include squares, herringbone, continuous strip, and other designs. Floors of this type are laid in mastic directly over the concrete subfloor. They are gaining in popularity for classrooms and gymnasiums.

The Maple Flooring Manufacturers Association is an educational and service organization. Since its founding in 1897, the association has been active in national advertising, publicity, trade promotion, and public relations activities. In addition to educational literature, technical papers on installation procedures for school floors are available free to the general public.

The current Association research program calls for performance tests of hardwood flooring after it is laid, practical tests of newly developed heavy duty floor finishes, and a major project aimed at developing data pertaining to expansion and contraction of northern hard maple floors. The objective of the current research is to compile, in readily usable form, pertinent information with respect to over-all shrinking and swelling of maple floors. This procedure will provide reliable data which can be used by floor layers, retail lumber dealers, and others to determine the expansion space necessary to compensate for the movement of wood in large floor areas.

Research of this kind is long overdue, as the northern hardwood flooring industry has real need of accurate information concerning the amount of expansion per square foot area and the allowances which must be made in various localities. Additional data will also be compiled to provide information on the square foot expansion due to changes in moisture content of maple flooring, regardless of the geographical location.

To gauge our research, the association has given much thought to the evaluation of floors insofar as they meet the approval of the general public. Our definition of a satisfactory flooring material is as follows:

1. A flooring material must lend structural strength to the building when required.

2. It must be highly wear-resistant to all types of traffic passing over it.

3. It must lend itself readily to numerous methods of installation and methods of finish.

4. It must not lose any of the first three requirements as a result of age, exposure to sunlight, or normal changes in temperature and humidity.

5. It must be comfortable under foot and not cause foot and leg fatigue to workers.

6. It should be an insulator from cold and should conduct heat.

7. It should have a pleasing appearance and be readily refinished by normal methods available to the general public, and it should be adaptable to changes in finish and color as may be required by changes in decorating schemes and fashions, without replacement.

8. It must be sanitary and non-slippery.

9. It should be economical to install and readily available, and it should add value to the building in which it is installed.

10. It must be of such nature that its surface can be repeatedly restored to its original appearance at a reasonable cost, and it should have a usable life—approximately that of the building itself.

Any material meeting the above 10 requirements should qualify as a satisfactory flooring material. In our opinion, northern hard maple meets all the 10 requirements.

With the foregoing definition in mind, let us examine what the northern hardwood flooring producers have done to try to evaluate the type of flooring they manufacture. The individual manufacturers, through their representatives, keep in touch with the trends in custom that may affect the floor requirements. As an example: when more and more concrete slab subfloors were being used, it was necessary to produce suitable types of wood flooring that could be laid with adhesives such as mastic. Then, when air-conditioning came along, further development in methods of application and bonding of the block and patterned flooring was required.

Through the cooperation of floor layers throughout the country, later confirmed by the Forest Products Laboratory, it has been found that certain areas of the country require different moisture contents of the finished flooring to give a satisfactory result when laid in mastic, the approximate variation being from 6 to 11 per cent when delivered on the job. Other refinements in laying procedure, plus the development of methods of laying strip and patterned flooring with adhesives, have solved these problems.

The industry, with the cooperation of the Maple Flooring Manufacturers Association, constantly keeps in touch with architects, engineers, and industrial and school officials to determine their problems. The association also has floor finishes tested and analyzed by recognized industrial testing laboratories.

Both the manufacturer and the consumer make use of, and cooperate with, the Forest Products Laboratory and the Bureau of Standards in trying to improve the product and its manufacture.

Cooperation with dry kiln manufacturers and the Forest Products Laboratory has resulted in greatly improved methods of artificial seasoning of green lumber.

Improvements in manufacture through the use of newly developed tools, such as carbide-tipped knives and saws, have been a factor in holding down costs.

Surveys are made regularly among the users and layers to determine the competitive position of the industry as related to what might be termed substitute materials. It is interesting to note that hardwood floors definitely add dollar value to a building. This is evidenced by the fact that, in issuing bonds, wood floors may be included in the base estimate of building value. Other types, such as floor coverings, cannot be included as they will have to be replaced during the life of the building.

While the foregoing comments are generalized to some extent, I believe certain detailed observations on hard maple floors and maintenance procedures should be covered in more detail.

A great deal of progress has been made during the past few years regarding the selection, laying, finishing, and maintaining of schoolroom floors. School officials and managers in charge of janitorial service are still experimenting and are far from reaching the reasonable attainable possibilities suggested by practical and economical methods. In considering economical methods of floor maintenance, let us dwell upon a product that, through experience and tests, may be considered the foundation upon which we build our economical system of floor maintenance. Hard maple flooring will give lasting service, even though no effort is made to establish a method or means of floor maintenance and cleaning.

There is only one kind of hard maple. Its large area of growth is in the northern states. Northern hard maple is dense and remarkably hard, durable, and resilient. Used for flooring, it has the unusual ability to resist pointed pressure without abrasion. Due to its tough-fibred, close-grained structure, it will not sliver.

As a result of these qualities, northern hard maple has won widespread recognition as the ultimate in flooring. In industrial, commercial, educational, and recreational buildings, it is used to provide long years of service, warmth, resilience, and comfort under foot. In the classroom, it is raising the health standards of the students and teachers, reducing fatigue, maintaining sanitation, and lowering maintenance and cleaning costs.

The next step is to construct a method of housekeeping that will add years to the life of the floor, as well as be an asset to the purchaser, to the owner, and to the public that treads upon its surface. In schools, it has proved that a well-established method of housekeeping is the keynote of sanitation which reflects upon the morale of the student.

In this connection, the Research Department of the Maple Flooring Manufacturers Association, working in cooperation with its official testing laboratory and the manufacturers of floor finish products, continues the search for improvement in service and heavy-duty finishes.

All products are tested by the official laboratory on northern hard maple (acer saccharum), but the Maple Flooring Manufacturers Association approved finishes are entirely satisfactory for use on northern hard beech and birch.

In addition to the testing procedure, association representatives are busy checking and observing the performance of Maple Flooring Manufacturers Association approved finishes on hard maple floors in school classrooms, gymnasiums, bakeries, industrial plants, stores, offices, commercial buildings, and residences.

The current specifications have been perfected by Maple Flooring Manufacturers Association researchers and the testing laboratory. They establish standards for finishes for both heavy duty and gymnasium floors, and are designed to give users of these floor-finishing products the benefit of the latest technological improvements. Floor finishes found to meet these specifications when tested by the official laboratory are placed on the Maple Flooring Manufacturers Association approved list and can be advertised and sold as approved products.

The specifications now in use establish numerical values for several test properties left indefinite previously. Toughness is defined by a Kauri reduction test; minimum abrasion resistance for heavy duty finishes is set at an index number of 150 by Taber abraser (250 for gymnasium finishes); color must not be darker than No. 13 according to the Gardner Color Standard; Sward hardness of the film must be at least 24; maximum viscosity is specified as A2 on the Gardner scale (C for gymnasium finishes); and a new test covers resistance to alcohol and naphtha.

Floor finishing products passing the Maple Flooring Manufacturers Association specification meet the following prime requirements:

1. The finish must penetrate the top surface of the wood. The finish must have penetrating qualities that become an integral part of the wood, so that after application it will only wear as the wood itself wears away.
2. The finish must seal the pores so as to keep out dirt and resist soil stains.
3. The finish, with its penetrating qualities, must not darken the wood, but must give the floor an attractive, satin-like sheen, showing the varying natural color of the wood.
4. The finish must reflect light so as to improve illumination.
5. The finish should be non-slippery.
6. The finish must not mar, scratch, or flake off.
7. The finish must be of such quality that, if it becomes necessary to touch up worn spots in heavy traffic lanes, this can be done without complete refinishing and will show a uniform appearance.
8. The finish (sealer) should be resistant to water.
9. The finish, after application, must not present a maintenance problem. It must insure economy in maintenance, so as to eliminate constant resanding and complete refinishing.

When we mention "heavy duty" finishes, we refer to the penetrating seal type that leaves no film on the surface. Through further Maple Flooring Manufacturers Association research, another type of floor finish has been discovered that can be used effectively on gymnasium floors,

especially when they are used primarily for sports activities. It can also be used for other floors subjected to light traffic. The finishes are composed of tough, resilient, long-wearing ingredients. They are of the "Bakelite" type, penetrating the top surface of the wood and at the same time leaving a varnish-like film on the surface. The finishes do not darken the wood nor show rubber burns. Floors finished with the products are non-slippery and are noted for fast playing. Attractive appearance and ease of cleaning and maintenance are assured with the use of these finishes.

Before the finish is applied, it is of utmost importance that the floor be properly sanded. It is our thought that the finest finish cannot make a poorly sanded floor look well. Now, northern hard maple flooring comes from the mill smoothly surfaced, but in laying any floor, slight inequalities, scratches, and other marks will appear. These can be removed by scraping or sanding. A really smooth sanding is essential for a good finish job. Newly laid floors should be scraped or sanded lengthwise with the grain. Number 2 or 2½ sandpaper is suggested for cutting off high spots and joints and number 1 sandpaper for the second cut. The final step, and this is the most important of all, is to finish with number 0 or 00 sandpaper, or both if necessary.

On the subject of floor cleaners, there are some excellent products on the market today. They are especially prepared for use in dressing up hardwood floors and really do a job in heavy duty cleaning. However, if the floor is heavily saturated with oil or stain, it may be necessary to employ other methods, such as the use of certain coarse powdered preparations. Here, we urge maintenance men to consult the experienced floor finishing engineers for the proper procedure in removing the blemishes. We mention this because certain preparations will burn the wood and cause a fuzzy appearance to the flooring strips.

We also have certain recommendations for normal surface cleaning of northern hard maple floors. In light cleaning, it is not necessary to treat the floor with water, as fine results can be had by dusting it clean with a soft brush, dry mop, or cloth. If slightly soiled or spot-stained, the spaces should be rubbed with a mop or cloth moistened with a small amount of penetrating seal, turpentine, or possibly a little furniture polish. This treatment over wax may mean rewaxing of the floor where the wax is dissolved.

The Maple Flooring Manufacturers Association Research Department will shortly begin the inspection of maple floor installations finished with certain plastic type products. If, in our opinion, they have merit, we will work with the manufacturers in gathering detailed information of interest to the general public.

I wish to thank you for giving me this opportunity to present these views concerning the use of northern hard maple for school floors.

Questions

Question: Is northern hard maple flooring available?

Answer: Yes, a large year for the industry is expected.

RADIANT HEATING

J. M. VANNIEUKERKEN

I was called in a number of years ago to study radiant heating for homes and other buildings. After two years of research and study I came away with the complete conviction that it is truly a wonderful system. My work in the many years following has served only to deepen that conviction. Of course there are certain merits and difficulties with any heating system, but I am convinced that radiant heating has more merits than any other.

Radiant heating has an ancient historical background. The Babylonians and even the Stone Age men knew about it and used it, although they did not understand the underlying principles. Even my dog uses radiant heating when he searches out a sheltered spot in the winter time and lies in the sun on a pile of leaves. All heat we receive from the sun gets here in the form of radiant heat. The basic principle of radiant heat is to protect from the wind and provide for a source of radiant heat energy. Rays of heat travel at the rate of 186,000 miles per second and can pass through a vacuum or travel a short distance into certain materials. They do not lose any of their energy in travelling nor do they heat up the atmosphere as they pass through it. Only when the heat rays from the sun strike the earth and are reflected or absorbed do they warm up the air. In the winter time it is the wind blowing or moving cold air that causes the major loss of heat from the body.

There is a fundamental concept in heating a building that is generally misunderstood by most people. People think that in order to be comfortable the heating system itself must warm them up. This is a fallacy. The body generates its own heat; it must lose some of this heat in order to be comfortable. A major way of losing this heat is by the evaporation of sweat and also by radiation. The human body generates about 500 B.T.U. per hour when not exercising, of which about 300 B.T.U. per hour must be lost in order to be comfortable. *The function of any heating system is to prevent a loss of heat beyond this point* and to prevent too rapid changes.

Radiant heating tries to do just this. It makes the surroundings of such a temperature that one can lose body heat at the right rate to be comfortable. The temperature of the air and the humidity do not necessarily determine the comfort of the occupants. It is possible to have an air temperature of 70 to 75 degrees and yet to be uncomfortable if one sits in the direct sunlight and receives large amounts of radiant heat. On the other hand, one can be uncomfortably cool in the same air temperature if he sits near a large cold window pane. In radiant heating we make the walls, floor, and ceiling of the room warmer but keep the air in the room relatively cool. And with cooler air in the room there is less perspiration and less need for extensive ventilation. Open-air schools have been successful in England and other European countries when a windbreak is provided and the ceiling and floor are provided with a source of radiant heat.

I have studied all types of radiant heating and am often asked about

the relative effectiveness of these various types. The panels which are heated may be in the floor, in the ceiling, at other points in the room, or in a combination of these. Within each type there are various methods of heating the panels, the major methods being by coils containing hot water embedded in the material, by electrical coils, and by circulating warm air.

I believe that the best single type has radiant panels in the ceiling. This is most effective for several reasons. Among them are:

1. There is a minimum of heat shadow.
2. The walls are better heated by radiation. Even the floor is somewhat heated if it is properly insulated.
3. The ceiling can be heated to a somewhat higher and hence more efficient temperature than the floor.
4. Heat loss to the ground is greatly reduced or eliminated.
5. There is a quicker response to controls in the ceiling type if floors have coverings, such as rugs or other surfacing materials.

Even with ceiling panels a serious heat loss may occur to the ground unless the floor is insulated. Actually, probably the best system is one in which both the ceiling and the floor are sources of radiant heat. *Any system in order to work properly and efficiently must be properly designed for the particular building and properly installed and operated in that building.*

You may know of the Levitt houses built outside New York City. All use radiant heat in the floors. It was only necessary to have the ground dry. Then a concrete slab was poured over the coils. When other builders tried to use this system on less favorable ground there were failures because there were terrific heat losses to the ground. Even when there is adequate insulation beneath the concrete slab the coils should be at least 2 to 3 inches from the bottom of the concrete.

I mentioned that the ceiling system could be heated to a higher temperature than the floor. In normal rooms 85° is the maximum temperature of the floor for comfort, but the ceiling can be heated several degrees warmer if desired.

Any system should be designed with consideration for the mass of the building. It is natural that with a large mass there will be slower heating, because the material itself must be heated and because the hot water generally has to travel greater distances in larger buildings. Proper design can reduce the lag in response to controls.

Here are a few principles to be observed when putting in a ceiling system. Always put in the coils first. Then put metal laths below and in good contact with the coils. It is very important to efficiency that contact is maintained between the coils and the laths. Finally, plaster is put on the laths and perhaps acoustical material on the plaster. This system should provide uniform heating throughout the room. There will be no cool corners, hot spots, or undesirable drafts.

I believe that the system of radiant heat for homes, public buildings, and office buildings is a major step forward in our efforts to make people more comfortable regardless of the weather outside. It is the most desirable system and the most natural system I know.

Questions

Question: What about the need for mechanical ventilation?

Answer: I believe none is needed in homes. In school buildings, where large numbers of children occupy a relatively small space, some sort of ventilation would be necessary. Avoid drafts, however.

Question: Is radiant heating appreciably cleaner than other systems?

Answer: Definitely yes. Convection currents carry dirt and deposit it on walls, ceilings, and throughout the room. Also, dust is carbonized in a radiator or hot air system and these particles are deposited on drapes, furniture, and so forth. Experience indicates that cleaning costs with radiant heating may be much less than half that when convection systems are used.

Question: Doesn't lag in response to controls sometimes make the room too hot when there is a sudden increase in outside temperature?

Answer: In a well designed system this effect is minimized. A balanced system with zone control is the best way to handle this. Switching from one zone to another to produce uniform conditions may be done. Also anticipation of temperature changes and adjustment of the controls early will help.

RADIANT HEATING

N. B. HONNIGFORD

We have had excellent results in installing Radian Tile in homes, public buildings, and office buildings. This system utilizes forced warm air which is circulated through Radian Tile in the floor. The tile contains three channels through which the warm air flows; on one end are three metal sleeves which fit inside the channels and extend about two inches. These sleeves fit into the adjacent block and, when the filler is poured, keep the channels clear and form a continuous passage.

The tile is made of hard burned clay, and either surface may be used face up, forming a fine tile floor. The thickness of the upper surface is about three fourths of an inch. While this is strong enough to withstand considerable weight and shock, it also provides for quick warming. This means that a minimum of time lag is present in response to heating controls. The block can be waxed and scoured, and is not affected by cigarette burns, acids, and the like. The tile makes a very attractive complete floor, with no floor covering necessary unless desired. However, rugs and other coverings may be used.

The complete system of radiant heating is as follows. A conventional hot air furnace is used, the only requirement being that a fan or forced air system be included. The warm air is forced through tile ducts to a row of perforated ducts along one side of the room. The air flows through the perforations into the tile blocks which form the floor itself. Thereafter it flows through the channels in the floor blocks to the opposite side of the room where it again enters perforations and is returned to the

furnace through another duct to be reheated and recirculated. (See diagrams.)

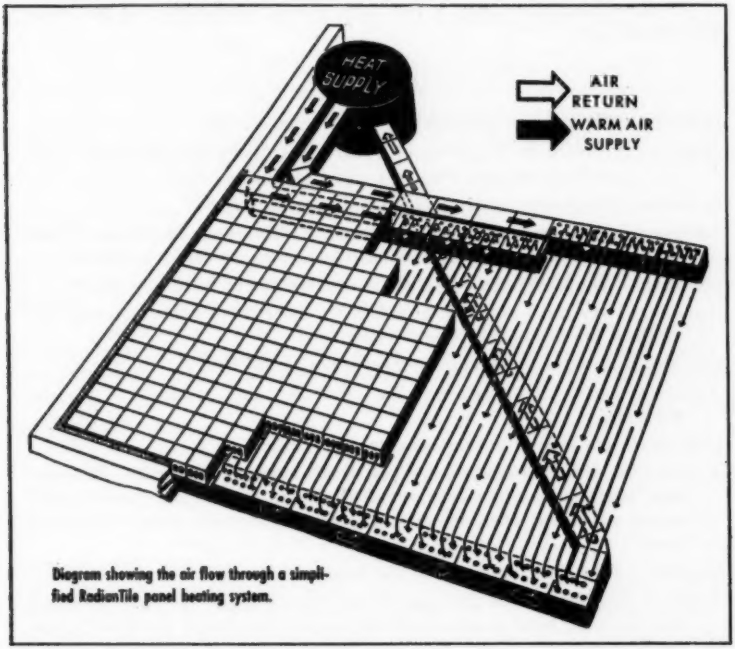

Diagram showing the air flow through a simplified RadianTile panel heating system.

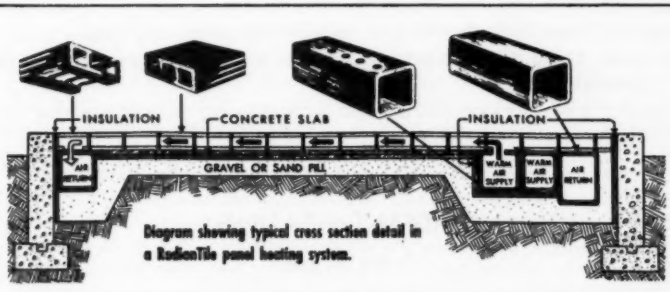

Diagram showing typical cross section detail in a RadianTile panel heating system.

This is a closed system; no air in the system enters the room. It is possible, however, to use Radian Tile in an open system in which the air may be circulated through the room.

The radiant heating system is most economical when used in a single floor building, since it is possible to have a sand base on which a thin

slab of concrete is poured, a layer of insulation put on the concrete, and the Radian Tile layed directly on top. A distinct advantage is the fact that you get a finished floor.

I have touched on only a few high points; gentlemen, do you have any questions?

Questions

Question: What is the estimated cost per square foot?

Answer: About 90 to 95 cents per square foot, including ducts and block but excluding concrete slab and other foundation costs.

Question: What about maintenance and operation costs?

Answer: Less than was expected. There is little or no maintenance cost in the floor and ducts. Individual blocks may be easily replaced.

Question: Would rugs or other acoustical treatment have any effect?

Answer: They have no adverse effect on the system except to increase slightly the lag in response to controls.

Question: What is the surface temperature of the floor?

Answer: Eighty-five degrees. We find anything warmer is uncomfortable.

Question: Is a special blower necessary?

Answer: No, conventional equipment works very satisfactorily. The system works better, however, when the warm air supply duct is relatively short and when one duct does not supply more than 400 square feet.

Question: How much weight will the floor withstand?

Answer: Six hundred to 900 pounds per square inch. We have installed the tile with good results in shops where very heavy machinery was used.

Question: How long has the system been in use?

Answer: Since 1947. It was first installed in houses in Chicago.

Question: Could this system be used in conjunction with another heating system?

Answer: Yes. For example, it could be used as the floor of a roofed and sheltered play area alone.

RADIANT HEATING

JAMES E. GOFF

Of all our environments, it is the thermal with which we are most continually at war. The body can adjust to darkness, light, silence, or loud noises with a remarkable degree of safety. Not so the thermal extremes against which the body has little protection. Therefore a large part of our lives is a never-ending struggle to master an unfriendly climate, and yet man has survived through his ability to rearrange his

climate. In this struggle with the climate, we are at a disadvantage with the lower animals. When winter comes, the birds fly south, the bear crawls into his cave to sleep through the winter, and the fur-bearing animals grow a new coat, which man promptly confiscates and sells at a profit. This brings me to the point of this discussion. Man must buy his protection from the cold.

Today I want to talk with you about the mechanism of body comfort. In order to understand body comfort, there is one thing that must be remembered. The human body does not need to be heated; rather, it generates heat well in excess of its needs and must be refrigerated at all times, else it will fail just as your car motor fails. Surprising as it seems, the body generates 500 B.T.U./hr when at rest, which is equivalent to the heat produced by a 150-watt lamp. Violent exercise increases this energy to 600 watts, while climbing stairs requires more than 1,200 watts. In fact, if this room in which you are seated were by some magical means to become a completely heat-proof, air-proof room, you would die from overheating before you would die from lack of oxygen.

If you are a school man who is short of funds, you might have the pupils run up and down the stairs all day and use the energy they generate to heat the building. Since one child power of heat is 1,000 watts, it would be easy to compute the number of children needed to keep the building warm.

The amount of heat varies not only with activity, but with age, sex, race, and diet. A 10-year-old generates the maximum B.T.U. per square foot of skin area, and the value decreases with age. After age 60 a substantially higher temperature is required for comfort. This is a fact which teachers should keep in mind when adjusting classroom temperature.

The body produces, regulates, and releases its heat by means of a highly sensitive thermostat located in the brain. It regulates body temperature by maintaining a constant check on the blood temperature. When the body has an excess supply of heat, it dilates the peripheral blood vessels to bring more heat to the skin surface. When the body is in short supply, it cuts down the flow to the skin and produces shivering; this is nature's way of making us work to keep warm.

One is comfortable only when the excess heat is liberated at approximately the same rate as it is generated. The skin is quite unable to differentiate between different avenues of heat loss. Nerve endings sense the rise and fall of temperature and the body attempts to compensate.

Until recent years, the mechanism of body comfort was not considered in the design of heating systems. The one aim was to pour heat into the house by the cheapest means possible. Everyone knows that if you run the temperature up high enough, you do not feel cold even though you do not necessarily feel comfortable. Air temperatures of 80° to 90° F. were common, and close control on humidity was necessary. Yet it was found that one felt entirely comfortable on a spring day in which the air temperature was only 70° and the humidity was normal.

Research people began investigating the problem of body comfort and found that the body liberated its heat by three means: convection, evaporation, and radiation. The last two of these are completely independent of air temperature in the comfort region.

Dr. Clarence A. Mills, Professor of Experimental Medicine at the University of Cincinnati, conducted an experiment in which a foil-lined room was used. An air conditioning system kept the air temperature at 95° F. and 80 per cent humidity. At the same time he had a cold panel on one wall to absorb radiant energy. Experimental animals then grew and behaved as though they were in cold air, while the girl who cared for them wore a sweater. In this killing heat the girl wore a sweater to keep warm because of the extreme radiant heat loss.

The General Electric Company showed, on the other hand, that comfort could be achieved by control of radiant heat loss. Subjects were placed in a foil lined room in which the air was kept at 57° and no heat was supplied. Due to reflection of radiant heat by the foil, the people felt as if they were in a normally heated room.

Tests such as these clearly illustrate that comfort cannot be obtained by consideration of air temperature, radiant temperature, or humidity alone. It is easy to see the error in the old-style heating system. Uninsulated cold walls presented a radiation sink, so that excessive air temperatures were required. This introduced a second evil. Since evaporation heat loss increases to the point where it must be controlled when the air temperature exceeds 76° F., high humidities were required. In brief, the old systems stifled convection and evaporation losses, while radiation losses ran wild.

At the other extreme, Dr. Mills has completed a house called Reflection Point, in which the walls are coated with decorative aluminum foil. The house is completely uninsulated, so that inside temperatures are permitted to follow outside temperatures quite closely. Trough heating coils are located in each room to set up a high radiation intensity. He has been in the house for part of two heating seasons and claims it is quite comfortable. In this system, evaporation does not need to be controlled, convection is allowed to run wild, while radiation losses are stifled.

In the ceiling radiant heating systems, which have gained so much popularity in recent years, we have attempted to attain a proper balance of these factors.

In the first place, we recommend that radiant heating be installed in well-insulated houses and buildings. Insulation keeps walls and air temperature close together as well as saves on the energy necessary to maintain the temperature. In practice, air temperatures of 70°, walls of 65°, and ceiling of 95° are common and provide a very comfortable environment. These temperatures vary with outside temperatures, however, and with the ratio of wall to ceiling area.

Present thinking on radiant heating can be summarized as follows: insulate well and allow air temperature to seek its own level, usually about 70° F. Provide a large area low temperature panel to supply radiation to balance body losses. The biggest improvement that the future holds is the addition of reflective walls and floors which permit lower air temperatures and less energy consumption. The second need is a thermostat designed exclusively for radiant heating that will respond automatically to the comfort equation and not to air temperature alone.

So far I have talked in completely general terms, with no mention of the manner in which electric radiant heating is accomplished. I believe electric radiant heating, as supplied by Ceilheat, has many advantages

over other methods. Ceilheat cable is a plastic-coated resistance wire designed for long life, heat stability, and ease of handling. It is installed on the ceiling lath prior to plastering. The plasterer then covers the wire with one half inch of plaster and this may be surfaced in any conventional manner, including acoustical treatment. The units are designed for 120- and 240-volt operation. In operation, the electric current which passes through the wire heats the plaster to 80° to 105° F. This provides the source of radiation necessary to balance body heat losses and provide proper body comfort.

Many people feel that electric radiant heating is too costly for a modest financial income. On the contrary, when all factors are considered, it is competitive in operation when electricity is available at 1 cent per K.W.H. Here are some typical costs for a five-room house with bath totaling 1,000 square feet of floor area. Costs include complete installation, material, and labor, with the unit ready to turn on. At Knoxville, Tennessee, complete installation averages $500 and the annual heating cost is $86.20. At Atlanta, Georgia, installation averages $450 and heating cost is $100.

Some of the advantages of Ceilheat over a floor type of radiant heat system are, first, that higher panel temperature is desirable and ceiling installations make this possible, and second, that there is less mass to be heated, and this makes for economy and quicker response. Also, heat shadows are less likely to occur or to be noticed. For example, when lying on a couch, one is largely shielded from a floor panel but not from the ceiling. It is only fair to point out, however, that one's feet may be shielded by a desk when a ceiling system is used. Actually, the most desirable system is a combination of ceiling and floor installations.

In comparing electric power and hot water sources of heat, it should be pointed out that the electric system is easier to control and requires no furnace and boiler system, but it is an off-on system by the very nature of electric thermostatic controls. On the other hand, hot water maintains a very constant temperature but is slower in response and harder to control.

CONVECTOR HEATING

PINKNEY VARBLE

My company is most pleased to have been invited to this important conference. If we succeed in contributing in even a small way to its success, we shall indeed be happy.

In a greater or lesser degree all steam and hot water heating systems are radiant heating systems; each has its greater or lesser proportion of heating by convection. Even the purest type of radiant heating includes to some degree the warmth and comfort produced by the movement of warmed air. By the same token all forms of convector heating have in them a certain proportion of radiant effect. The best example of such a combination is to be found in a radiator which I shall describe.

Imagine a small cabinet-like radiator which fits under a window snug against the wall. Within the cabinet we find a cast iron radiator with an opening at the bottom for he entry of cooler air off of the floor. Internal vertical tubes are surrounded by iron, which is heated by steam or water. These tubes change direction and curve toward the front, having their terminus at the face of the radiator. The cooler air at the floor level is drawn into the opening at the bottom by the chimney effect produced in these heated tubes. The air is warmed, rises, and is discharged from the face of the radiator into the room. This is convector heating in its finest form. To some extent, the top and ends of the radiator warm the adjacent walls of the room, purely by conduction. These walls give off radiant heat. They also provide a warm panel where room air passes, absorbs warmth, and is delivered to objects and occupants of the space involved. In this extreme example of the combination of convection and radiant heating, about 50 per cent of the face of this radiator produces pure radiant heat.

When the architect thinks of a convector of the purely conventional type he has in mind the exterior appearance. The architect is principally concerned with appearance, space occupied, and adequate comfort in the space to be warmed. A typical example would include a steel cabinet with air inlet at the bottom and an air discharge grill near the top, with some sort of a heating element inside to warm the air which reaches it. A chain may be used for the operation of the damper. The damper is used to control movement of air through the cabinet, and thus to control the heat output.

The engineer, however, is more concerned with the part that is not visible, the heating element itself. He is primarily interested in how much heat this heating element will produce, and with its measurements.

Commercially, heating elements are of two general types—non-ferrous and cast iron. The headers on each end of a conventional non-ferrous convector are hollow cast iron. There are four copper tubes running parallel from one header to the other in a typical example. These copper tubes are rolled and expanded into the cast iron headers, so that a permanently tight connection will be assured. Attached to these tubes are metal fins, usually of copper or aluminum. All non-ferrous convector heating elements look very much alike. The steam or water enters the header at one end at the bottom and the condensation from the steam and the steam or cooler water in circulation leaves the convector at the opposite header, at the bottom.

This is the principle of operation of convector heating. The steam or water gives off its heat to the tubes. The tubes pass their heat to the fins. The fins warm the air which passes over them. The cabinet provides the chimney and controls the direction of flow of the air.

No doubt the finest type of conventional convector element is made entirely of cast iron. Such an element is composed of end sections or headers, just as in the non-ferrous type, and hollow casting or intermediate sections, each having staggered fins on all four surfaces of each section. These convectors are available in a varying number of rows of sections to meet the space and heat output requirement of the problem at hand. These cast iron units offer many advantages which result in the

ultimate in comfort from convector heating. Their cost sometimes limits their use on projects where price is a dominant factor.

At some time or other you may have wondered what there is behind the front of the cabinets which you have seen in schools, churches, and office buildings. Behind the cover or front is simply some type of convector element such as we have described, hung by brackets at each end of the element. There is also some type of damper and control valves. The best types of convector cabinets have removable fronts; this feature makes it possible to get to the heating element easily for cleaning purposes or the servicing of control valves and thermostatic traps.

The cabinet, sometimes called an enclosure, may be installed in several positions. It may be used free, standing on the floor with its back to the wall; it may be installed in a recess in the wall; or it may be hung on the wall. The type that is hung on the wall is quite generally used in educational, commercial, and industrial buildings. There is a type similar to this which can be hung on a sloping wall. In all of these types there is an open bottom and a discharge grill at the top. If the discharge grill is sloping, it discourages people who might sit on top of a cabinet.

Convector elements and cabinets are commercially available in four widths, 10 lengths, and six heights. Such a selection is necessary in order to have available a unit to fit almost any space condition.

There are many modifications of these general types. There are cabinets with fronts which overlap the recess opening. There are also cabinets with return flanges which allow for the use of a convector element with a depth greater than the depth of the recess in the wall. There are also cabinet fronts which are designed to receive plaster, wood paneling, or marble between the inlet at the bottom and the discharge grill near the top. Almost any type of standard commercial cabinet or any other chimney effect built into the wall construction will be adequate so long as the architect and engineer adhere to the basic principles of convector heating. So you see the architect and the engineer have plenty of latitude in designing their distribution of warmth and achieving the appearance that they desire.

In summary, convector heating has much to recommend it:

1. It can be used with either steam or water systems with equal success.

2. It saves floor space.

3. Its response (the output of warmth) to either steam or water is rapid.

4. Its control by dampers, hand control valves, or automatically controlled valves is positive.

5. At the present time, the cost of non-ferrous convectors and steel cabinets is less than the cost of conventional floor-type cast iron radiators.

6. There is no maintenance cost to be anticipated on either type of heating element or on any type of enclosure. This equipment will last as long as you or I, or as long as our children live.

7. The fact that heat output can be placed where it will do the most good makes it possible for the engineer to design his heating system in such a way that every nook and corner of a room is blessed with the comfort of June warmth.

You may have already suspected that I like it—and I do.

CLASSROOM HEATING AND VENTILATION

W. F. CURRISE

Medical men, school officials, and engineers have long realized that classroom efficiency and thermal comfort are closely related. Two main divisions of thermal comfort are heating and ventilation.

Heating in a classroom is designed primarily to overcome the heat loss due to the large glass area in the modern classroom. At moderate temperatures and below, this glass area becomes a wall of ice to those seated near it.

Ventilation has two primary functions in relation to thermal comfort: heat removal and odor removal. Heat removal is based on four factors: the number of pupils in the room, direct sunlight entering the room, minimum temperature of entering air to avoid objectional drafts, and the outside temperature. Factors related to odor removal have been determined by experimentation. Mr. Yaglou, of Pennsylvania, ran comprehensive tests using an experimental classroom in which he varied the amount of fresh air. Specially trained judges tested the odor level periodically in the occupied room and recorded their results on a scale. Although subjective, the results showed that high correlation and valid standards have been determined regarding ventilation and odor level.

With this background let us look at the Indiana State Code as found in the booklet entitled *Heating, Ventilating, and Air Conditioning Regulations.* This set of regulations was written by a group of men who pooled their experience and knowledge along with a great deal of research.

The various types of heating and ventilating systems for classrooms may be classified under four general groups: old systems, central fan systems, split systems, and unit ventilators.

The first old system to be discussed is the system composed of cast iron radiators and gravity type ventilation. The radiator was controlled manually by a valve at the radiator. The control of the room temperature was very poor, and there was much overheating and underheating. One could not be certain of a definite volume of ventilation air, and the odor level was usually high.

The next and probably more prominent system is the direct-indirect system. This is sometimes called the C. C. Shipp system, after its promoter. This system consisted of a cast iron radiator located beneath a window on the outside wall of the room. Behind this radiator was a fresh air intake. The radiator and intake were enclosed by a sheet metal enclosure which served as an air-sealing chamber and decorative cover. Located somewhere in the center of the building was an exhaust flue with an exhaust fan. This fan was for the purpose of drawing in the air through the fresh air intake; the air was then heated by the radiator before being discharged into the room. In some systems the fan was omitted and an "aspirator radiator" took its place. This was nothing more than a radiator that was to heat the exhaust air and induce a draft or air movement that would pull in outside air through the fresh air intake.

The disadvantages of this system are poor control of the room temperature, and the fact that there was no guarantee that the fan would pull the air through the radiator intake. If an outside door or window was open, or an excessive crack area was present around the window, the fan would pull air in through these openings and by-pass the radiator. Under strong winds the windward side of the building would be under pressure and air would be blown through the opening at a rate in excess of the capacity of the radiator, thus creating drafts. On the leeward side there would be a relative vacuum, and the air would be pulled from the room to the outside through the radiator. In the case of the aspirator radiator there is no guarantee of the proper amount of ventilation air, but the largest objection is the excessive cost due to waste heat in heating the air exhausted in the atmosphere. This is just like throwing the coal or other fuel out the window.

The second large category to cover is the central fan system, named thus because all the equipment is located in one spot. The elements of this type of system consisted of a fresh air inlet, fresh air damper, recirculating air inlet, recirculating air dampers, filter, heating medium, fan, and supply duct to convey air to the rooms.

Various types of heating mediums have been used. One consisted of a warm air furnace to heat the air. Some used a large bank of heavy cast iron radiation with a trade name of Vento. The present-day trend is to use fin tube radiation. This consists of a tube of copper or Admiralty metal which acts as a steam or hot water passage. Then fins of copper or aluminum are spirally wound around the tube to aid in the heat transfer.

This type of system was designed to handle both the heat loss and ventilation air. In order to heat the room the air was introduced from the warm or interior wall of the room and directed toward the outside wall at a temperature higher than the design room temperature. The air, upon cooling, gave up its heat to the room. Since the air entered at a temperature higher than that of the room, this type was termed the "hot blast system." The temperature of the air leaving the coil and entering the room was controlled by a thermostat which called for higher temperatures when the room temperature dropped.

A refinement of this system was known as the hot and cold deck system. This system was primarily the same and consisted of fresh and recirculating air dampers, filters, a preheating coil that would heat the air to approximately 50°, and a supply fan. On the leaving side of the fan there was a sheet metal housing or box. This box was split horizontally so that there was an upper passage and a lower passage. In the upper passage was located another heating coil called the hot deck. The lower passage handled the tempered air only and was called the cold deck. At the end of each of these decks was located a set of dampers that worked at right angles to each other.

The system again was controlled by a room thermostat tied into the dampers on the hot and cold deck.

As the room began to overheat, the thermostat would call for entering air at a lower temperature. The thermostat would accomplish this by partially closing the hot deck damper and opening the cold deck damper

more, adding more cool air to the mixture and achieving a lower mixture temperature which cooled down the room. By use of the dampers tied in with the thermostat, the room conditions could be controlled more evenly. It was merely a refinement to provide better thermal comfort in the room.

As schools became larger and more varied in their occupancy and purpose, engineers realized that they must compensate for the changes. It was necessary to break the building into sections or zones because of variations in number occupying each room, activities carried on in the different rooms, differences in age groups having different thermal requirements, and the fact that some sections were in the sun and some in the shade. It was a simple step to replace the one large set of hot and cold deck dampers with a number of smaller sets corresponding to the number of zones. A separate zone thermostat controlled each set, and in this manner the varying load requirements of the individual zones were met. This type of system is referred to as the central fan zone system.

As people became more cognizant of the fact that humidity was a measure of the thermal conditions of a space as well as of the dry bulb temperature, they began using the air washer. This consisted of a set of nozzles located in the air stream, a tank to catch the spray water, and a circulating pump to take the water from the tank and force it through the sprays. The humidity was controlled by a humidistat and, as the humidity decreased below the design condition, the humidistat turned on the sprays. The air washer served two additional purposes. It acted as an additional filter and it helped cool the air by reducing the dry bulb temperature to approach the wet bulb temperature during the saturation process.

Another main topic is the split system. This consists of a central fan system plus additional cast iron radiation in the classroom. The auxiliary radiation was sized to carry the heat load, and the fan system was sized to carry the ventilation load plus a slight amount of the room heat loss.

The control cycle for this used to be that a room thermostat was tied in with the fan system and the radiation. As the room began to reach design conditions, the radiation was turned off first and warm air from the fan system carried the heat loss. Upon a drop in temperature the fan system temperature was raised and, if the room temperature continued to drop, the radiation was turned on. The more up-to-date thinking on this subject is to reverse this control cycle. As the room temperature drops below the design condition, the auxiliary radiation is turned on, and if a drop is continued the fan system adds heat. This protects the student seated by the outside wall from feeling cold due to a drop in the wall surface temperature. This drop is overcome by the auxiliary radiation heating this surface.

The last of the four systems is the unit ventilator system. The unit ventilator is nothing more than a small central fan system located within each classroom and serving only one classroom.

The fresh air intake of a unit ventilator is mounted in the outside wall and consists of V-type louvers and a bird screen which keeps foreign particles from being carried through. The V-louvers are primarily used

to keep the wind and snow from being blown into the opening and on into the classroom.

The next mechanism is the air volume stabilizer. In order to better explain its function, let us review a simple law of physics to the effect that the volume is equal to the area times the velocity of the fluid flowing. When there is a strong wind outside on the building face there is a tendency for the air to be blown on through the unit vent faster than the radiator can heat it, and cold drafts result. However, as the wind velocity increases these vanes swing up and restrict the area. Thus a higher velocity with less area results in the same volume. Then the air passes through the filters and on into the mixing chamber.

On the room recirculation side, the air is taken in through recirculating grilles at the bottom of the unit, passes through a filter, and enters the mixing chamber. Please note that the fan is located below the coil. One of the primary reasons for this is that low temperature air circulates over the motor and motor bearings and tends to give them longer life than when hot air from the radiator is passed over them. I would also like to point out a human element in this arrangement. We all know that children are curious and that they also like to make noise. It is great sport for them to drop pencils and paper clips, etc., through the grille of the unit to hear them rattle around in the fan. In this case the items would fall on the radiator and no harm would be done.

Please note the mixing damper whose purpose is to vary the amount of fresh and recirculating air as demanded by the room. It accomplishes this by pivoting about its axis and restricting one side or the other. Then the air passes through the radiator, is heated, and then passes through the directed flow outlet and on into the classroom.

I would like to call your attention to the section labeled "comfort control." This device samples the unheated air and, as the outside air temperature drops, it demands that the air leaving the coil be at a higher temperature. For example, when the outside temperature is 0°, the air stream temperature should be at least 80°, or cold drafts will result.

There are three basic control cycles for the unit ventilator, the F, A, and O cycles.

The F cycle is the 100 per cent outside air cycle. During the heating up period the damper is closed to the outdoor air and all the air is recirculated. This takes place in the morning prior to the arrival of the students. Just before the room reaches the design conditions, say three degrees below the room design, the damper swings to the 100 per cent outdoor air position and the temperature of the air leaving is controlled by the room thermostat. The colder the room the hotter the air.

The A cycle is the most common in this area. It is described as a variable quantity of outdoor air with a fixed minimum. According to the state code, 30 cfm per pupil must be circulated, of which 10 cfm is outdoor air. This amounts to 33⅓ per cent fresh air; therefore the damper is set for a minimum of 33⅓ per cent and never at any time is there less than this quantity. It is possible to use more than 33⅓ per cent outside air when the room is overheating and outside air is used for cooling. This is controlled by the room thermostat. Again, as in the F cycle, prior to occupancy in the morning the air is recirculated completely to accomplish quick heating up.

The O cycle is a variable quantity of outdoor air without a fixed minimum. During the heating up period the unit ventilator recirculates all the air until the room is 3° below design conditions, then the damper swings to a position so that the mixture temperature entering the fan is always approximately 60°. Then the radiator adds heat as called for by the room thermostat. In this cycle the damper can go from 100 per cent outside air to 0 per cent outside air.

Now let us compare some advantages and disadvantages of the central fan system and the unit ventilator system. The advantages of the central fan system are: the system is all in one room and can be kept under key to prevent tampering; heavy equipment gives long life; a large fan has greater force; good filtering is possible; air washing may be used to control humidity; and janitorial costs are lower. Two disadvantages are the high initial cost and limited flexibility. It is difficult to compensate for changes of room load due to sun, occupancy, and degree of activity.

The unit ventilator system has the advantages of maximum flexibility since each room is individually controlled, and lower initial cost due to ease of installation. There is, however, higher maintenance cost due to the servicing of many small motors and separate filters. There is relatively no humidity control, and there is objection to the individual outside wall boxes which become dirty and may streak and stain the face of the building.

Either of these systems has many good points, and consultations regarding the local needs and situation will be necessary before a sound decision can be made. Consideration must be given to the four important requirements for modern schoolroom comfort: quick economical heating, adequate ventilation, cooling, and control and balance. The result will be proper thermal comfort in the classroom.

SOUND TREATMENT

ROBERT F. SEERY

We, as manufacturers, do not get an opportunity to talk directly to the users of our products as frequently as we would like. While talking with several of you earlier today, I could see that you do have questions about the proper use of acoustical products. I wonder how many of you have been in a room where speech has been garbled because of too many echoes? How many of you have had rooms treated and found that you still had a noise problem? Or maybe you have decreased the effectiveness of your acoustical material by painting and would like to know whether it can be restored.

The science of acoustics can be separated into two parts: (1) sound absorption, and (2) sound transmission. It is important that the difference between these two terms be understood.

Absorption of sound is controlled by using materials with high sound absorbing powers. Typical examples are drapes, carpets, acoustical plaster, certain wall materials, acoustical tile, or even people themselves.

When a room has a reverberation time (or echo) too long to make speech audible, sound absorbing materials are used.

Transmission of sound is controlled by its isolation, either at the source or by intermediate enclosures, usually a partition. Manufacturers of certain machinery or equipment can mount their equipment in some resilient mounting in order that the sound will not be transmitted to the surrounding structure. This is controlling sound at its source. Transmission of sound can be controlled by building enclosures, walls, floors, and ceilings of proper materials. Noise created in one room that passes through the partition, annoying occupants in the adjacent room, is an example of sound transmission.

Once you have your problem pin-pointed to reverberation or transmission, half of your worries are over. The other half will be over when you find where you are going to get the money to do the job.

Sound absorption is the dissipation of the vibrational energy of sound. There are two methods by which this can be accomplished. One method employs a porous material with many tiny interconnected cells or channels. These tiny cells dissipate sound by the viscosity of air and friction against the walls of the channels. The other method employs flexural vibration under the alternating pressure of the sound waves (diaphramatic action). Most acoustical materials develop their sound-absorbing powers through porosity, although all materials undoubtedly gain a little absorption by diaphramatic action—some more than others.

There are many types of acoustical plasters. Their differences lie in the basic materials. These plasters can be made of perlite, vermiculite, lime, magnesite, or gypsum bases. Porosity can be attained by the addition of foaming agents in the plaster mix or a certain amount of shrinkage. The foaming agent produces many tiny cells, and the shrinkage produces voids and cracks interconnecting the cells.

A perlite base material, such as Sabinite, develops porosity by a foaming agent, properly graded perlite aggregate, and organic fibers which shrink while drying. The surface is troweled to a smooth finish and small pores appear in the surface.

A vermiculite base material, such as Vercoustic, is made with vermiculite and clay and depends on the shrinkage of the clay to develop porosity. The surface is left rough, usually a floated finish.

A lime base material, like Kilnoise, develops porosity by a foaming agent and shrinkage, but perforates its surface to develop connecting channels with the interior cells. Red Top acoustical plaster, a gypsum base material, depends on this same principle to develop its absorption.

A magnesite base, like Softone, will develop porosity by a foaming agent and shrinkage, leaving a rough floated surface.

Acoustical tiles can be classified into two types: (1) those made of combustible materials, and (2) those made of incombustible materials. Combustible units are made from wood or cane fiber boards. Some combustible tiles are painted with special fire retardant paint to render them slow burning or fire retardant. Those made of incombustible materials can be cast of any of the materials that we discussed for plasters: metal, asbestos, or fibers of glass.

Tiles are classified under federal specifications by their surface appearance, such as pitted or granular appearance, or units having a me-

chanically perforated surface, a fissured surface, or a felted fiber surface.

Now you may ask what effect painting has on these materials. One principle of sound absorbent materials is that, if 10 per cent of the total surface area is open, practically 100 per cent of the sound energy is transmitted to the absorbent in back of it. The perforated metal acoustical pan operates on this principle. It has a hard metal face and an absorbent blanket behind that face.

When an acoustical plaster is first installed, the face has a large number of very tiny openings which allow the sound energy to be transmitted into the material. A few coats of paint applied with a brush will soon film these tiny openings, thus closing the pores and not allowing the porosity of the material to play its part in absorbing the sound. However, applying paint by the spray method and thinning the painting medium to a lighter consistency will allow the acoustical plaster to take more paintings and still be operative. Here again, the larger the openings in the surface, the more paintings will be permitted. Thus, a plaster with a perforated finish, like Red Top acoustical plaster or Kilnoise, will stand more spray paintings than others.

Acoustical tiles with mechanically perforated faces and certain fissured surfaces have proved to be so open after several coats of brush painting that their effectiveness is not destroyed.

Some units may actually benefit slightly from the effect of a coat of paint (due to the diaphramatic action mentioned earlier) or the material may gain absorption at certain frequencies and lose at others, usually gaining at the lower frequencies and losing at the higher ones.

Acoustical materials are rated by a noise reduction coefficient which is an average of several sound frequencies within an audible range. When choosing a tile for a specific job, attention should be given to the absorption at various frequencies. If you are treating an office where noises from typewriters, office equipment, and the like are among the annoying ones, then a material should be chosen which is most efficient at higher frequencies. Tiles can be chosen to do almost any type of sound-absorbing job. Theoretically speaking, the flatter the curve, or the more uniform absorption at all frequencies, the more desirable the material in question.

Another question in your mind may be the advisability of using one type of material in preference to another. There are so many pros and cons regarding the use of each type of product that, for practical purposes, the choice will be up to the owner or architect in question.

If I were choosing an acoustical material, I would first ask if the need for treatment should be met with the use of combustible or incombustible materials. How much space is available for treatment, and how efficient a material should I buy? Will the material require frequent maintenance, paintings, or washings? Is the location of the tile subject to any abuse? Is there excessive moisture present that would be harmful to certain materials?

If you can satisfy these questions for your own requirements, then the choice of the materials will be narrowed down to a selected group, and the contractors can bid accordingly.

FENESTRA COMBINATION STRUCTURAL AND ACOUSTICAL UNITS

R. F. BATCHEN

Fenestra combination structural and acoustical units are manufactured by the Building Panel Division of the Detroit Steel Products Company.

Fenestra acoustical products not only provide acoustical treatment for an area, but they also provide the structural system for the area. Fenestra acoustical products are the only material of this type on the market at the present time.

There are four general types of fenestra acoustical products: acoustical "AD" panels, acoustical "D" panels, acoustical "C" panels, and acoustical Holorib.

Basically the products consist of a metal sheet which is perforated with ⅛" round holes so placed that approximately 10 per cent open area is provided for the entrance of sound energy and the sound absorbing element. The sound absorbing element is a glass fiber insulation and is supported ¼" from the holes by a wire chair.

Acoustical "AD" panels. Acoustical "AD" panels provide the basic structural system for either floors or roofs. They are available in various depths (3", 4½", 6", and 7½") and gauges (14, 16, and 18), depending on the structural requirements. The panels are available in lengths up to 24'.

Sound absorption tests conducted on acoustical "AD" panels indicate they have a noise reduction coefficient of 0.80. The complete results of the tests are published in Bulletin no. 13 of the Acoustical Materials Association.

The advantages of acoustical "AD" panels are:

1. The panels provide a combination structural and acoustical unit, which combines a function of roof or floor deck, joists, hangers, and acoustical ceiling into one packaged unit.
2. The panels are easily and speedily erected.
3. The panels need only the application of a finished coat of paint over the shop primer to present the final completed installation.
4. The panels do not soil easily and can be cleaned with soap and water.
5. The panels are of incombustible construction.
6. The panels eliminate the use of an excessive amount of structural steel.

Acoustical "D" panels. Acoustical "D" panels differ from acoustical "AD" panels in the fact that they provide a ceiling which has a beam effect rather than the smooth ceiling of the acoustical "AD" panel. The acoustical "D" panel is manufactured in the same depths and gauges, and also spans 24'.

The noise reduction coefficient of acoustical "D" panels is 0.70. The advantages of acoustical "D" panels are the same as those of "AD" panels, with the additional feature of being less expensive.

Acoustical "C" panels. Acoustical "C" panels are designed for use as partitions in various types of buildings. They are perforated on one side and are available in either aluminum or steel in lengths up to 14'.

The noise reduction coefficient of the acoustical "C" panel is 0.85. The complete test results of this panel are published in the 1951 *Bulletin* of the Acoustical Materials Association. The noise reduction coefficient of 0.85 is the highest coefficient listed by the Acoustical Materials Association for any acoustical material.

The advantages of the acoustical "C" panel are:

1. It is easy and quick to install.
2. It is neat in architectural appearance.
3. It is non-combustible.
4. It is a durable material which will take rough usage.
5. It is movable, to accommodate desired space changes.

Acoustical Holorib. Acoustical Holorib is used solely for roof conconstruction and is available in lengths up to 20', with the restriction that the maximum span of the material is 6'8".

The noise reduction coefficient of this type of acoustical material is 0.65. The complete results may be found in the 1951 *Bulletin* of the Acoustical Materials Association.

The advantages of acoustical Holorib are primarily the same as those indicated for acoustical "D" and "AD" panels, with the additional feature that it is the least expensive of the acoustical products offered by the Detroit Steel Products Company.

Conclusion. Fenestra Acoustical products have had an ever-increasing demand, especially with the advent of the low-cost school building program into which they readily fit. As an example of their popularity, there now exist, in the State of Michigan alone, approximately 90 schools which have used Fenestra acoustical products for their gymnasiums, recreation halls, and classrooms.

A comparison of cost that takes into account the completeness offered by Fenestra structural and acoustical units, their neatness, and their freedom from maintenance expense show them to be more economical than any collection of elements that would make up to a comparable installation.

SOUND TREATMENT WITH GLASS FIBERS

DANIEL MORGENROTH

Glass is made by the use of great heat and flame so intense that sand, limestone, and other mineral components are melted and blended in a formula designed to give maximum chemical and physical stability. In the manufacturing process, molten glass is formed into fine fibers under carefully controlled techniques.

The basic form of fiberglas is a soft, fleecy white wool, referred to as type TWF insulating wool. This product has found many applications as an acoustical medium, such as being placed behind tapestries, curtains,

perforated hard surfaces, and in other places where covering or protecting panels were employed.

This TWF wool is combined with a small amount of highly stable binding agent and is compressed and bonded into a board form which adds greatly to the versatility of forms for varied applications.

This bonded material is known generally as PF wool. It is made in a variety of thicknesses, from 1″ to 4″ thick, and the density may vary from 1 to 12 pounds per cubic foot, thus making available many combinations of thicknesses and weights.

The very nature of the basic material provides an inherently incombustible media of high acoustical value. No further processing is required to improve its sound absorbing quality. During World War II the National Defense Research Committee sponsored a program of acoustical research at the Cruft Laboratory, Harvard University, dealing with the problems of acoustic transmission and the development of acoustical instruments. In order to carry out the task as efficiently as possible, it was found necessary to construct an echo-free chamber. This was accomplished by lining the walls, floor, and ceiling of a room with wedges made of glass fibers. These wedges averaged 40″ in length and were 8″ square at the base. Since 1945, several of these chambers have been built for the Parmley Foundation for Auditory Research at the Armour Research Foundation, for the Navy Department in Anacostia, and for the Central Institute for the Deaf in St. Louis. At Wright-Patterson Field, Dayton, the Aero-Medical Laboratory is carrying on research in such a soundproof room in an effort to determine methods for the preservation of hearing.

Another application to show the versatility of fiberglas may be found in the Janke cylinders used as air intake and exhaust for jet engine test stands. These cylinders are in pipe form with an inner cover of hardware cloth and an outer cover of perforated aluminum. Janke and Company, of Hackensack, New Jersey, are manufacturers of aircraft testing equipment and have developed this method of soothing the howls of an engine under test. These cylinders are suspended in staggered rows at the intake and exhaust ends of test cells. The cylinder design makes maximum use of the glass fiber-sound absorbing medium. Both inside and outside cylinder areas of 17 square feet are exposed for sound absorption. This is a big advantage over fire brick—the conventional absorbent materials used in this application—which, when built into a cell wall, presents only half its surface to the sounds. The Janke absorbers are 7½′ long, 9″ in diameter, and weigh 20 pounds apiece.

A modification of the wedge principle, as used in the anechoic chamber, is adapted to a lighting system manufactured and distributed by the Wakefield Brass Company, Vermillion, Ohio. A large amount of research has been done by Bell Telephone Laboratories in the design and mounting of suspended absorbers for maximum effectiveness. Through special licensing from Bell Telephone, the benefits of Bell research and patents are now available for general use in the Wakefield luminar-acoustical ceiling. The baffles are wedge-shaped, made of perforated enameled steel, and filled with fiberglas wool. The fiberglas core is spaced approximately ¼″ away from the perforated metal sheath. With only 10 per cent opening in the sheath, the material behaves as if it were transparent to sound.

Another application for low-density PF material may be found in the Fenestra building panels manufactured by Detroit Steel Products Company. This combining of the functions of roof or floor deck and acoustical ceiling into one packaged panel was very ably covered by Mr. Batchen.

A high-density board of fiberglas PF is being used as a permanent form for poured-in-place gypsum and light-weight aggregate concrete roof decks. In this application, advantage is taken not only of the excellent sound-absorbing property of fiberglas, but also of its low heat transmission. There are many variations of the poured-in-place method. Subpurlins, or bulb tees, are spaced 32½″ apart on centers and are welded to the main purlins. The fiberglas form board is placed between the subpurlins, resting on the bottom flange. Standard reinforcing mesh is then rolled out over the roof area and the gypsum or light-weight aggregate concrete is poured and screeded to the proper thickness.

Fiberglas form boards are adaptable to flat, curved, or pitched roof framing. Low initial cost, coupled with the fact that it forms an integral part of the construction, makes this installation economical. The exposed board presents a ceiling that is both functional and pleasing in appearance and requires little or no maintenance. This construction is ideal for shops, gymnasiums, cafeterias, corridors, and classrooms.

A lower-density form of fiberglas PF board is given a factory-applied paint finish. This product is installed on a "T" grid system type of suspended ceiling. This system is made of extruded aluminum parts which are prefabricated and made ready for installation. This design offers architects, builders, and designers a durable, light-weight, attractive finished ceiling at a cost approximately that of conventional non-acoustical ceilings. The combination of properties available in this type of ceiling provides for modern design, effective lighting, sound control, and fire safety in one application. This system can be used either in constructing new buildings or in modernizing existing buildings and is adaptable to large or small areas. In new buildings this type of ceiling may be installed at any stage of construction after the roof is made waterproof, as high humidity conditions do not restrict its application.

A ceiling can be installed in either a square 24″ by 24″ or ashlar pattern 24″ by 48″. The fiberglas boards are easy to install and may be cut accurately and easily with a knife to conform to irregular openings and ceiling boundaries. The system offers accessibility into the attic space above for maintenance functions and emergencies. The ceiling boards may be replaced, when desired, with sheet glass, plastic or "egg crate" type, light diffusion panels. This permits use of economical concealed lighting fixtures. The total weight of the installed ceiling is less than one pound per square foot as compared with 10 pounds per square foot for metal lath and plaster. The ceiling board has excellent thermal properties, thus contributing to more economical operation of heating and air conditioning systems. Should more insulation be required, any thickness of fiberglas roll building insulation can be rolled on top of the board; standard 24″ wide rolls can be used.

Another application for fiberglas PF board is as duct insulation. When fiberglas board is placed on the inside of air conditioning ducts, it not only insulates the duct thermally but also insulates acoustically by

absorbing the noise that may emanate from the fans or from other rooms. This board makes an excellent incombustible sound-absorbing duct liner.

Most of the applications for fiberglas acoustical material have been in the lighter-density or in the large-board size. The PF insulation, when compressed to high density, can be readily fabricated into acoustical units commonly known as acoustical tile. Fiberglas acoustical tiles are made in three styles—textured, perforated, and membrane-faced. Fiberglas plain acoustical tile is a highly decorative material of architectural beauty. It is white in color and has a light uniform texture with excellent light-diffusing properties. Fiberglas perforated acoustical tile is made of the same base material as is used to make fiberglas plain tile. This tile is cleanly perforated with 196 holes per square foot, a plain rectangular arrangement. This tile is used in places where it may require excessive maintenance. It may be brushed or sprayed readily with oil paint, enamel, lacquer, or water-base paint. The perforations are of large enough diameter, 5/32", so that the paint will not easily bridge over the opening.

Several years ago, while sound absorption tests were being conducted on fiberglas boards of various densities and thicknesses, it was discovered that the sound absorption of cellophane-wrapped boards did not differ greatly from that of plain boards. As a result of this discovery, a new membrane-covered tile was developed using the diaphragm principle. For this product the same base board as is used for other prefabricated units is used with a non-burning plastic film stretched over the surface and adhered to the edges. There are several advantages to this tile, as it has an air-impervious surface and is, therefore, very easily and economically maintained by washing. This tile is also rated incombustible in accordance with the federal specification SS-A-118a. Although this tile is slightly higher in price at the present time, it makes for excellent application in kitchens, dining areas, scrubbing rooms, hospitals, and other locations where cleanliness and sanitation are important factors. The information on this tile will be released publicly in the new 1951 *AMA Bulletin* which will be issued shortly. This tile, as well as our other acoustical units, can be installed by both the adhesive and the mechanical method.

As fiberglas units are dimensionally stable, the applicator can install the units side by side without either conditioning them in the space into which they are to be installed or leaving spaces between them to allow for contraction and expansion. Due to the light weight of fiberglas acoustical units and their dimensional stability, they are well adapted to mechanical application systems. Any standard application system employing a lower flange to engage the units in the kerf of the tile can be used with fiberglas units. There are many acoustical systems on the market today, and it is best to select one that is self-aligning.

The newest addition to the varied products made from fiberglas is the noise-stop baffle which can be suspended from wires or other methods beneath the ceiling. This unit absorbs sound on both sides. When hung in continuous rows 4′ to 5′ on centers, these baffles will cause a loudness reduction in the area of approximately 50 per cent. These units can be installed readily by maintenance men or carpenters in existing structures as well as in new constructions. No special skill or attachments are re-

quired. In order to reduce the noise level in such places as manual training rooms, machine shops, etc., these baffles can be hung in continuous or broken pattern. They are easily maintained and are also incombustible.

One can readily see that, with the diversified forms of fiberglas for acoustical treatment, there is a wide variety of applications that are limited only by the ingenuity of the designer, engineer, and architect.

Discussion Period

[During the discussion period which followed the presentations concerning the use of acoustical materials for sound treatment, many questions were asked by those present dealing with problems in their own schools. In answering these questions it was pointed out that each sound problem required a thorough study by an acoustics engineer to determine what type of acoustical material would function best in each installation. Failure to heed this advice has resulted in many examples of costly sound treatment that have provided disappointing results.

Also, it was brought out that the quantity of acoustical material used is equally as important as the type. An example was cited where an excessive use of acoustical material in a band practice room had created such an unrealistic condition that it was difficult for both the director and the band members to adjust to the concert room conditions.

Information was given that any manufacturer of acoustical materials would furnish competent engineers to study sound problems in both old and new construction and to make recommendations for satisfactory solutions.]

SCHOOL BUILDING NEEDS IN THE STATE OF INDIANA[1]

WILBUR YOUNG

Wilbur Young, Indiana State Superintendent of Public Instruction, emphasized that we are behind in our school building program. He opened his talk with the story of Rip Van Winkle's son, who went to sleep for 100 years. When he awoke he saw strange objects scurrying up and down hard-surfaced roads like ants. He saw strange objects flying through the air. Everywhere he looked he saw strange objects, new type buildings, and he was indeed lost until he looked down the road and saw one familiar landmark. It was the schoolhouse, still standing and looking much the same as it did 100 years before—the same red brick, the same permanent seats.

In the past, buildings were constructed and the educational program was centered around the limitations of the building. Today the reverse is true. We build our educational program first and then build the school building to fit that program.

Mr. Young introduced Dr. H. L. Smith, Dean Emeritus of the School of Education, Indiana University, now with the State Department of

[1] Report of speech.

Public Instruction, whose primary duty it is "to see that school buildings are so planned that the buildings fit the needs of the educational program."

Superintendent Young said he could not discuss the school building needs in Indiana in detail, because there are not enough facts available. While there have been studies made (one by the Indiana School Study Commission), these have been made on a sampling basis or as independent studies in certain communities, such as the Indiana University study of Harrison County or the Purdue University study of Elkhart County, rather than in the state as a whole. Mr. Young pointed out the overcrowded conditions in various areas, many areas having an acute shortage in school buildings. On the other hand, some areas, such as Benton County, have more school space than they need. The problem is not only the construction of new buildings but also replacement, additions, rehabilitation, and improvement in maintenance.

Mr. Young insisted it was facts we need, and he chose to discuss three phases of his five-point legislative program designed to get the facts and give a basis for the solution of the problems.

The House Concurrent Resolution No. 18, The School Survey, calls for an eight-member committee to be appointed to make a survey of the schools in the state of Indiana. Dean Wendell W. Wright, of the School of Education, Indiana University, was chosen chairman of that committee. The state appropriated $25,000 for the survey.

Mr. Young complimented Dean Wright for his work so far in getting other educators interested and in securing $74,000 from the federal government and other sources for the survey, thus bringing the total to more than $100,000 and enabling the state to have the type of survey that is required.

With the completion of the survey should come the answer to the problem of consolidation. The survey is to be completed by December 1, 1952, and should be presented by the state superintendent to the 1953 General Assembly. What Dean Wright and his committee recommend will be the recommendation made by Mr. Young to the General Assembly.

Mr. Young stated that we cannot build the needed buildings because of lack of funds. Then he outlined the three methods by which schools may obtain building funds.

1. Local bonds. The total school district and civil township has a constitutional limitation of 4 per cent of assessed evaluation for bonded indebtedness (2 per cent for each unit of government). At present costs about one room could be built each year from an assessed evaluation of $1,000,000, allowing $40,000 bonded indebtedness for schools.

2. Sinking fund. Seventy-five cents on $100 permitted for a sinking fund would bring $7,500 a year, which, in six or seven years, would finance one room.

3. Holding Act, 1947. This act was a method of circumventing the constitution. Bonding companies, afraid of the constitutionality of the act, made it so difficult to build under the 1947 Holding Act that you can count the number of schools on both hands that were built under the act.

Mr. Young estimated we need $120,000,000 for school buildings in Indiana, with no good law to permit financing.

House Bill 390, Holding Company Act 1951, is the establishment of a holding company at the state level. With this act, buildings are built and paid for on a lease-rental basis. The state acts as agency and sells the bonds. The school corporation pays.

House Bill 390 is in the stage of trial now. Approximately 75 schools have requested building aids. Elkhart and Indianapolis want to take the bill to the Supreme Court to find out whether it is constitutional. It is the first time the state has ever tried acting as a holding company. If the procedure is approved by the Supreme Court, a precedent will be set and bonding companies will feel freer to bid on school bonds issued by the state.

Mr. Young said he had been assured that there would be no question of the constitutionality of the act. December or January will bring the answer, after which time we can probably build schools on a state basis.

People want to know the answer. From the way it is drawn up, House Bill 390 seems to be a sound bill. One very important part of the bill is the requirement that a school survey be made. The survey must find that a building program is needed. Schools must be built on a scientific basis.

The third part of the legislative program that Mr. Young chose to discuss was the tuition support act. Mr. Young felt that the $53,000,000 allocated was not enough. He recommended $68,500,000, which he felt was still $10,500,000 below what is needed to do the job as it should be done.

The $79,000,000 which Mr. Young felt necessary to do the job right was discouraged by the Governor.

Mr. Young asked that school and community make their views known, as the State Department of Public Instruction wants their suggestions.

The sum of $400,000 last year for maintenance was not large enough. Larger sums than this are needed merely to maintain existing structures. We need larger funds for higher salaries for teachers and administrators.

Mr. Young said he had another bill which he did not present to the legislature, a reorganization bill. He said he did not present it because we do not have the facts necessary to pass the right type of reorganization bill.

What is the right type of reorganization bill? There have been many theories. The Bi-partisan Commission which Dr. Wright is heading will find the facts, and whatever that Commission recommends will be the bill presented to the 1953 General Assembly.

"Then we will know where the buildings are to be located and the type we want," Mr. Young concluded. "I am not interested in school buildings that are a monument to poor judgment."

FUTURE TRENDS IN SCHOOL BUILDING PLANNING

J. W. CANNON, JR.

In 1942-1943 when the major concern of most of us was with the successful prosecution of World War II, new school building construction

was almost nonexistent. However, there was a great awareness of the tremendous backlog of school building needs that were then accumulating, and much thought and speculation were being given to the kind of school buildings we would construct when the war was over.

You may recall that at that time there were some rather fantastic advertising campaigns hinting at many Buck Rogers types of products that would be available after the return to peace—products which would revolutionize our methods of living and effect radical changes in building construction. We now know that most of these promises were never fulfilled and that building construction, whether it be home, office, or school, is still dependent on the same essential ingredients of brick, stone, plaster, cement, steel, wood, and glass. To be sure, there have been and will continue to be constant refinements and product improvement in lighting, heating, flooring, acoustics, and other features of new school building, but these have not and will not be the major factors in determining future school building design.

The one truly great factor which will determine the future of school building design is to be found in the hearts and the minds of the men and women who will have the responsibility of building those buildings. It will be found in the attitude with which they approach that problem. The buildings of the future will be a reflection of their concept of the function and purpose of a school. A new school can be built with unlimited use of money and can incorporate every latest product development and still be a dismal failure if the basic concept of its purpose and function is not in accord with the latest developments in educational philosophy and practice.

We have only to look at the many schools constructed in the early 1900's to see how design and construction are primarily a reflection of the attitude of those responsible for the building program. Whether they then knew it or not, it is quite evident to us today that the vast majority of those buildings are monumental in concept. In most of them there is little evidence that any real thought was given to the educational needs of the child and the teacher. They are manifestations of the adult idea of what a school should be: imposing, substantial, austere, rigid.

What will the school of tomorrow look like? Frankly, I don't know. I can tell you what I hope it will be. I hope it will be a child-centered school. At a recent school dedication which I attended I heard the chairman of the building committee say, "I hope you, the citizens of the community, like this school. I hope you as parents feel that your school board has given you a school to be proud of. But truly, whether you do or don't is really of little importance, for the real test of whether we have built a good school is not what you think of it, but what the pupils think of it. If it stimulates them to learn, if it provides them with a healthy and safe environment, if it instills in them a desire to grow into honest responsible intelligent citizens, then and only then can it be considered a successful school building." In my estimation such an attitude is an essential ingredient in planning the school of tomorrow.

However, important as it is to approach our school building planning with that frame of mind, there is still the problem of finding out what a child-centered school actually is. We must be continually searching to learn how the child thinks, how he learns, how he reacts to his surround-

ings, how he grows physically and mentally. It is not an easy job to know these things and, as in all things, there is a good deal of conflicting opinion. As we learn these things and strive to design our school buildings accordingly, we shall continue to improve our school plants.

Let me cite an example of what I mean. It is now rather universally agreed that a homelike atmosphere in the school gives the younger child a greater sense of security and a greater sense of belonging. But a homelike atmosphere is difficult if not impossible to obtain if we project him into a kindergarten or first grade room with 12′ ceilings when he has been accustomed to 8½′ or 9′ ceilings at home. Having decided that lower ceilings are important, we find that we have created a problem of adequate distribution of daylight. How to get more and better light distribution with lower ceilings and therefore with shorter windows becomes a challenge in school design. The effort to solve this problem has resulted in many different answers: clerestories, glass block, floor to ceiling windows with vertical fins on the outside, and numerous other devices. One of the latest attempts has been a plastic skylight. Probably there will never be complete unanimity on how such a problem is best solved, but the attempt to find out has had and will continue to have a significant impact on the appearance of our school buildings.

As I look into the crystal ball and read the tea leaves, trying to answer the question of what our future schools will be like, I can only see that good design must follow the educational needs of the pupil. Therefore, if we can determine the ideal environment for all stages of the educational program from kindergarten through high school, we shall have established the basic controlling elements of future design, providing we consider the additional factor of flexibility which will allow changes as we continue to learn more and more about the way children learn. If, then, we are to build the school of tomorrow today, we can do so by determining that ideal environment and becoming acquainted with all the latest technological developments which are available for providing that environment.

The question then is, "How can we determine the ideal environment?" To a large extent the answer to this question will be dependent on the general type of building we have under consideration—that is, whether we are building an elementary school, a junior high school, or a senior high school. In the elementary school of kindergarten through sixth grade, the major activity is confined to the home classroom. An elementary school building is essentially a horizontal expansion of classrooms and an arrangement of them about the common facilities of gymnasium, auditorium, cafeteria, library, administrative suite, health center, corridors, project rooms, exits, and playground, so that these areas will be conventionally accessible to the pupils and, if intended for community use, they can be available to the public without having to open the entire building.

In general, such planning of elementary schools is best done with a one-story structure. Should I be charged with the responsibility of planning such a building today, I would operate on the principle that the heart of such a structure is the classroom, where the major educational activity is centered. I would then ask every teacher to give me his or her

ideas on the ideal classroom without regard to cost, space, or any other restriction. Having been connected with a recent school building project in which we did just such a thing, I have a pretty good idea of the type of response we could expect. The most common factors would be greater space, greater flexibility, greater storage capacity within the classroom, and more area for project display. I would then try to develop that ideal elementary classroom. As the one having the major responsibility, in which case I should be the superintendent of schools, I would temper these utopias with my own knowledge of the importance of artificial and natural lighting, heating, temperature control, acoustics, flooring, and certainly the factor of daily cleaning and annual maintenance, and so develop an approach to the ideal classroom.

The next step, with the help and guidance of the imaginative architect we have retained, would be to arrange those classrooms in relation to the common facilities of gymnasium, auditorium, administration, and all the other facilities I have mentioned. How this is to be done will be dependent, too, on many factors: size of site, terrain, boldness of architect and school authorities, and such practical considerations as cost. The future trends on school building planning are going to be determined by those architects and school authorities who have the boldness, the ingenuity, and the daring to experiment.

My observations of school building progress lead me to believe that we have not arrived at our present stage of rather successful school buildings by a steady upward incline, but rather by a series of steps. Those steps have been made by the superintendents and architects who have had the daring confidence to take a fresh approach to the problems of educational planning. While I realize the tendency of those who are spending trusteed money to rely on the tried and true, my hat is off to those who have had the confident daring to experiment and so set new patterns for future school buildings.

In building a high school we have a somewhat different problem from that of building an elementary school. Now the individual classroom is no longer the center of educational activity. Instead, we have a series of specialized rooms for physics, chemistry, homemaking, art, shop, social studies, commercial courses, and others. Every 50 or 55 minutes of the school day we have a shifting of students from one subject to another, with a five-minute period or less to get from one room to another. In a large high school this practically requires a two-story building; otherwise the distances and the traffic become too great a problem. In planning such a building we are even more concerned with the individual requirements of the separate departments, and we should certainly seek the advice of those responsible for the academic program in order to know as much as possible about it.

School building plans cannot be picked off the shelf of an architect, but we can learn a great deal from examining the plans and seeing as many new school buildings as possible for, no matter how clever and ingenious we may be, we can all learn something from examining the way the other fellow has approached the problem.

Probably the greatest deterrent to good school planning has been a restricted site. Forward-looking school systems will anticipate their needs

years ahead and think of their future sites in terms of acres, not of square feet. The school plant is not just the building, but the surrounding ground as well. They should be developed together into a harmonious and functional entity.

Another stumbling block in building good schools has been poor public relations.

Perhaps I have not answered the question that Paul Seagers assigned to me, namely "Future Trends in School Building Design." If he expected me to tell you of technological developments which would affect school building design, he is perhaps disappointed. I can only tell you that I think that the manufacturers of lighting, heating, acoustics, seating, chalkboard, flooring, lockers, yes, and even structural products, such as steel joist windows and roofing, have been greatly concerned with the needs of schools and have anticipated your requirements. The technological developments are here. The future of school building design is in your hands.

FUTURE TRENDS IN SCHOOL BUILDING PLANNING

HOWARD ECKEL

The job of providing new schools is big business in America today. Thousands of new school buildings are being built. They are being built to house the great increase in populations which began a decade ago and is still going strong. They are being built for a rapidly expanding program of education. They are being built for many kinds of activities and for all ages and types of people.

In one of the recent studies made by our organization, the American School Publishing Corporation, we asked public, private, and college school systems to give us figures on building construction costs in 1950. We also asked for anticipated costs of planned projects. Cost figures from this study are very impressive.

We found, for example, that over two billion dollars were spent for new school buildings in 1950. This is a dramatic increase over the 1¼ billion spent in 1949. If school building construction continues as planned, it looks as though 1951 building will be near three billion dollars.

Sixty-two hundred new schools were built in 1950, while 7,000 were being planned for 1951.

You folks in the Hoosier state showed concrete evidence of your concern for school building needs. You built nearly 100 new elementary and secondary schools in 1950 at a cost of 30½ millions. Five sixths of this sum went for elementary school construction. You planned to build another 100 public school buildings this year at a slightly greater cost—or I should say you thought a slightly greater cost.

I give you these large sums to point out the fact that school building construction is big business in terms of dollars spent. School building construction is not only big business, it is very important business. We all know that the quantity of buildings to house our growing school population is important. But I want to make my plea for the quality of spaces

being provided for America's boys and girls. By quality of spaces, I do not mean the type of bricks and mortar used in the structure. I am speaking here of the design, characteristics, and relationships of building spaces.

Studies prove—and our common sense will show it fully as well—that the quality of building spaces does limit the school program. We cannot fit one shape of school program into another shape any more than we can fit a 52 size man into a 25 size suit. We should know the size and shape of our school program before we construct spaces to fit that program.

Early in the planning process let's be sure that we spend the time and effort necessary to formulate and identify the school program that we need and want. If we do this well, it calls for the unselfish services of many school people, citizens, consultants, and others.

When we know what our school program is to be, we are ready to measure that program so that the spaces provided will not only fit, but —like a growing boy's overalls—will provide for normal growth until a new one can be provided.

Let's do all that we can to see that the necessary funds to build needed schools will continue to be made available. However, let's not lose track of the one simple fact that school buildings have a much greater function to perform than to provide square footage of floor space for children. The job before us is to see that every one of the billions of dollars which we are spending for new buildings will buy the most and best in terms of school program.

Role of the American School Publishing Corporation

The publishing field is new to me. When I joined the staff of the American School Publishing Corporation one year ago, one thing which particularly interested me was the large number of school building activities in which Dr. Cocking and his staff participate. Let me point out a few of these activities.

We attend and organize conferences dealing with school building construction. We often attend and participate in the type of conference which you are having here in Bloomington. Let me cite an example of the type of conference or seminar which we often organize. When Anthony Part, school building specialist from England, started a tour of America's school buildings last November, we invited a small group of outstanding school architects for a discussion of modern English school architecture. I believe all present gained from the experience.

We visit architects, superintendents, consultants, and others who are in some way concerned with improving school building planning, design, and construction. They keep us close to school building problems.

We visit dozens of new schools each year. We often tour these buildings with others who also have an interest in school building design. The exchange of ideas about strong and weak features is most helpful to us.

We study the literature dealing with school buildings. We look for areas which deserve additional treatment, and we try to reflect this need in our publications. Also, if we feel an area has been adequately treated in other publications, we steer away from that area in *The American*

School and University and *The School Executive*. Biennially, we point out to *American School and University* readers our interpretation of selected books, articles, pamphlets, and other guides dealing with the various phases of school building planning and design.

We often work with architects and school systems in various consultative capacities. Communities often need help in setting planning machinery into operation. We are in position to know how many other communities have faced planning tasks—what pitfalls they experienced and what methods were successful. Also, architects often need to form a partnership with an educator who has made school building planning a specialty. We gain immeasurably by our practical experience with communities and architects.

Finally, we conduct a large number of primary research projects each year. Our research department looks for unexplored fields. We feel that we are in a unique position to contribute by conducting research in certain phases of school building design and construction. Let me cite two of our recent studies as illustrations.

A few moments ago, I described costs of school buildings constructed in 1950. These figures came from our annual nationwide study of school building costs. The inquiry blank for this study was sent to nearly 9,000 schools. A follow-up went to 6,200 schools. Nearly 70 per cent of these schools responded—which is an excellent return on a study of this type.

Another study made by our department was a detailed analysis of features in 60 selected classrooms. Complete results of these two studies will appear in the 1951-1952 edition of *The American School and University*.

On the basis of our experience with school building activities, I would like to outline what we believe to be the major trends in school building costs, design, and equipment today.

Just a word about costs. School building costs continue to rise. This advance has been steady now for the past 16 months. Costs are double what they were in 1939. The rise in building prices has slowed down temporarily. However, the basic causes for additional price increases are still with us. Unless there is a drastic change in governmental policy, prices are almost certain to start up again.

The process of school plant planning is vital in a democracy. In our society, we are not only concerned about our destination, but we are also concerned about how we get there. We believe that cooperative decisions are superior to authoritarian directives. What are the trends in the way that school buildings are planned? Who is involved in plant planning? What procedures and processes are used? What is different in the way planning is conducted today as compared with a few years ago?

Many people are cooperating in school building planning. Literally hundreds of citizens have some part in collecting and analyzing data necessary for designing a tailor-made building. Laymen work on curriculum committees, enrollment forecast committees, finance committees, and many other action groups. Voters in such communities not only understand what their new buildings are to be used for, they help decide what they shall be used for. We believe two very evident things result from this type of planning. First, it has been shown time and again that citi-

zen Joe Doakes will vote to tax himself even more than we educators would suggest when he knows the values and purposes to be served. Second, few bond elections fail if the people, through committees, participate in making decisions. One word of caution—don't try to fool citizens by getting them on committees so they will support predetermined building programs. Let us be sincere and honest in true cooperative planning.

School staffs are also taking a larger part in the planning processes. Why shouldn't they have a bigger part in planning future school buildings? They are the ones who will use them. After all, teachers, custodians, and food service people should have a very real contribution to make. More schools throughout America are stimulating these important resource people to be closely associated with school plant planning.

The educational consultant is also becoming increasingly evident in planning school plants. His role is not that of a so-called expert who makes decisions for the people, but of one who helps citizens, school staff, superintendent, and architect to see and face vital planning problems themselves.

The superintendent of schools continues to be a very important person in school building programs. He still attends meetings every evening of the week, and he continues to be awake the rest of the night considering how this or that can be done. Superintendents continue to lose their jobs after they supervise a building because "mistakes were made" or "he lost touch with the rest of the program."

However, there is evidence that the superintendent is becoming a coordinator of all the individuals and groups who participate in the building program. In place of making decisions, he is becoming a worker with all groups to see that decisions are made. He stimulates architect, school staff, students, and citizens to roll up their sleeves and work on vital fundamental problems. His role is becoming one of coordinator rather than of technical expert on school plants.

The group process of school plant planning which is growing in evidence today is a far departure from the school board-superintendent planning practiced a few years ago. Also, the tailor-built schools which we are getting in many American communities today are a far cry from the carbon copy types so common a few years ago.

What has and is happening to school building design? What new features have evolved from 1950's 6,000 new school buildings? What will be the design tendencies in 1951's 7,000 new educational buildings? Let's take a look at some changing features of modern school buildings.

1. The monumental school building is being replaced by buildings shaped internally and externally by the uses to which they are to be put. In one of our recent studies we found that three fourths of the school buildings constructed between 1930 and 1940 were monumental. Only one fourth of the buildings built since 1940 were monumental. We learned that nine out of ten school architects prefer school buildings designed for use rather than designed as monuments to a past culture. Educators and architects everywhere are saying that it is high time we delete the costly monumental frills and spend all our dollars for useful educational spaces.

2. School buildings are being designed for the size, needs, and inter

ests of those who will use them—especially in the elementary schools. Chalkboards, bulletin boards, furniture, storage spaces, sinks, drinking fountains, and toilets are being tailored to the size of the users.

We do not see as much evidence that high schools are being designed for young people with unique interests and needs. The high school building continues to be built around a series of subject-matter fields, rather than designed for a particular age group. We believe, however, that a growing number of architects and educators are beginning to face the secondary program problem. There is hope that some progress will have been made when the present influx of children reach secondary school age.

3. More attention is being given to multiple uses of school plant spaces. The old type of "six hours per day" school building is disappearing. Modern buildings are used from early until late by all age groups. The expanded use of school plants has created some challenging problems for the plant designer; for example: where to store materials used for adult programs, how to provide space for adult-sized furniture and special equipment, and how to plan the school plant so that programs for many age groups can be effectively administered. There are many problems. Some interesting answers have evolved. There is yet a great deal to be done.

4. Technical aspects of school buildings are being improved. Research and experimentation to find the most effective methods of daylighting and artificial lighting are being conducted in many places in our country. Various arrangements of bilateral lighting, clerestory windows, directional glass blocks, sloping ceilings, room colors, shrubs, grass, louvers, and canopies are being manipulated in an attempt to find the best way to daylight school spaces. The final lighting answer has yet to be found.

Sound control is receiving more attention. In the heating field, the radiant heating method appears to be gaining popularity. We now know that radiant heating may be used successfully in the northern states as well as in states with milder climates. Ceiling, wall, and floor colors are being carefully studied. We know that color has an effect on light quality and also a psychological effect on room occupants. We believe school designers will continue to study and experiment with various technical aspects of school buildings.

Safety is being emphasized. More than three fourths of new construction are fire resistive. Nearly all architects favor this type of construction. We believe the fire resistive building is here to stay.

Fewer schools now have central heating plants under the school building. Several states have state regulations controlling the location of heating plants.

Increasing care is being given to safety factors in relation to the school site. Site size and its relation to traffic and other hazards are considered important in site selection.

5. A large majority of new school buildings are one-story structures. Of the new elementary school buildings constructed in 1950, three fourths are one-story structures. Over one half of 1950's new secondary buildings have one story. The percentage of one-story buildings built in 1950 would

doubtless have been larger if 40 per cent of these new buildings had not been additions. Two- or three-story additions were often necessary to fit into the old building pattern. Also, only 30 per cent of the buildings constructed between 1930 and 1940 had one story as compared to 60 per cent since 1940.

Nearly all architects favor one-story structures for future buildings.

6. Only 15 per cent of all elementary school buildings built last year have basements. Of 1950's secondary schools, 18 per cent have basements. In comparing school buildings of the past two decades, we find that 27 per cent of those constructed between 1930 and 1940 had basements, while only 19 per cent constructed since 1940 have basements. Apparently the school basement is dying a long overdue death.

7. Increased attention is being given to esthetics in school buildings.

A few weeks ago, a group of us visited the South School, New Canaan, Connecticut. When I entered the building, I felt what we mean by esthetics. The building's lines, color, lighting—in fact, all features of the building—were blended to create beauty, balance, and an atmosphere of quietness. The new Cannan school was not particularly expensive. Esthetical values so outstanding in that building were more the result of good design than expensive materials. I'm glad that we are finally realizing that children appreciate beauty too.

8. School buildings constructed in 1950 and those being planned have more adequate facilities for services which we often think of as auxiliary. Spaces for lunchrooms, kitchens, guidance, health, teachers' lounges, audio-visual facilities, administration, and others are being considered as permanent important spaces for modern school programs. More attention is being given to facilities and equipment in these spaces.

In September of last year we made an extensive study of 60 selected classrooms. Our findings point out at least five general trends in classroom design. Here they are briefly:

1. Square and odd-shaped classrooms are becoming more common in America's schools.

2. Classrooms are being made much larger now than they were a few years ago.

3. Classrooms are being designed so that outdoor space is handy for children. Roofed porches, outdoor classrooms, and doors leading directly to the outside are being included as a part of many school plants.

4. The self-contained classroom is becoming more common. In these classrooms, children find equipment and facilities to meet nearly all of their normal and natural needs without going outside the classroom.

5. Technical aspects of classrooms are being improved. Great attention is being given to color, acoustics, light without glare, heating, and ventilation.

Classroom design is undergoing rapid and drastic changes in America's new school buildings.

The Challenge

There is a real challenge for the next few years in the school building field. U.S. Office of Education Commissioner McGrath says that we will need 14 billion dollars for school buildings during the next 10 years.

As we enter a period of inflation, shortages, and high taxes, there is a real danger that we will decide that we cannot afford to spend 14 billion dollars for school buildings.

If the cost of new school buildings becomes so great that we must cut national expenditures elsewhere in order to supply these buildings—just what expenditures will we cut? Last year, alcoholic beverages cost us four times as much as new school buildings constructed during the same period. The cost of tobacco was twice that of new schools.

Here is another way to look at it. A mile of two-lane concrete road costs anywhere from $200,000 to $1,000,000. The cost of a mile of the least expensive road would certainly be a help on a new school. The whole question is one of values—which of two things is more important if we cannot have them both?

Are we really serious about providing enough dollars to build the number and quality of school buildings needed in America?

A second challenging question which all of us can do something about if we will is that of how to identify and describe a school program around which a school building can be designed. How do we encourage citizens and staff to take a real part in planning a community program? How do we spell this program out, and how is the program to be reflected in school design?

One more challenge—how can we design a school building for a world which changes so fast that a building is almost obsolete before it is used? How can we provide spaces so flexible that they will accommodate an unknown school program?

These are samples of the many challenges which we face. We believe that America will make the right choice about education for its people. We are confident that American citizens will face the challenge to provide good schools for all America's youth.

FUTURE TRENDS IN SCHOOL BUILDING PLANNING[1]

FRANK G. LOPEZ

Grand Rapids, Michigan, because of pressure by the real estate people, had not had an increase in taxes for the past 25 years. As a result, there had not been a school building built in the past 25 years. Last year, when the schoolhouse shortage became so acute that children were only going to school half days, the people finally decided something had to be done. Forty-two schools needed to be replaced. Grand Rapids was on the spot. They had to go to the state legislature for approval to exceed their bonded indebtedness. As a result, Grand Rapids voted a $6,000,000 bond issue. Taxes were raised.

The bond issue was just the beginning. People then wanted to know about schools. There was no one in the community who knew about the latest in school buildings from first-hand experience, since it had been 25 years since they had built a school building.

[1] Report of speech.

The people wanted to know the kinds of buildings they would need—not just for today but for the next 25 years. They were interested in room size and shape and lighting, and also in building materials. One teacher wanted to know if in the building program there were to be facilities to compensate for or aid the youth who spends most of his free time watching television and movies or playing games which result in his being too tired to do justice to his studies.

Frank G. Lopez, Senior Associate Editor, *Architectural Record,* speaking before the final general session of the Building Planning Conference, said there are many cities facing such a problem as Grand Rapids has faced—towns and cities that have not built any school buildings in the past quarter of a century and are now becoming acutely aware of their shortages. The people in these towns want to know the answers.

The answers to their problems point to the future trends in school buildings. The kindergarten is now mandatory in many states and permissive in others. Pre-kindergarten is encouraged in many states. Some states are adding grades 13 and 14, or junior college, in many school systems. These trends increase the building needs and problems. The schools are concerned with the use that society makes of its increased leisure time. Parents want better things for their children than they had when they were young. Provision of such things as rest cots in the lower elementary grades is not uncommon today. Social service courses for adults (adult education) are quite common.

Building expenses have gone up. Manufacturers of building materials of all kinds make claims in regard to the merits of their particular product. People are interested in building the best building possible as economically as possible. As a result, new ideas are being introduced and the architect is more important than ever before.

Mr. Lopez told of a young architect who conceived the idea of cutting down on the perimeter wall of the school building by changing direction of the classrooms.[2] The long side of the classroom, which usually is the window wall, became the inside wall and the end walls of the classrooms became the outside or window wall and the wall facing the corridor. Buildings with their rooms arranged in this manner had less perimeter wall, which is very expensive, and less corridor, which is an unacademic and unproductive area. This was done with no loss in floor space per classroom.

The rectangular classroom with the windows on the short end creates a problem in lighting. The natural light from the windows does not allow sufficient light to reach the front of the room.

Mr. Lopez told how several architects solved this problem.[3] Skylights have been tried, but it is extremely difficult to build a skylight that will keep out water. The clerestory is used in many cases, but often there is a dark spot directly below the clerestory caused by a contrast between the lights at each end of the room. The dark spot was rectified in one school by the use of carefully angled aluminum louvers.

Another school was having another difficulty. Every type of arti-

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[2] See lower left-hand corner of page 120 in the June, 1951, *Architectural Journal* for a drawing and explanation of this idea.

[3] See upper right-hand corner of page 130 of the June, 1951, *Architectural Journal* for a drawing of this plan.

ficial lighting seemed to develop a "hot spot." The natural lighting came from windows on one side and a clerestory window on the other. The clerestory window was covered by a monitor. The architect finally had the industrial type of fluorescent fixture concealed in the monitor and behind the clerestory to give the classroom indirect lighting. There were no other visible fixtures in the room except two over the chalkboard. Mr. Lopez said he was in the building on one of the gloomiest days and the effect was very good. The fluorescent fixtures were almost imperceptible as a light source when lighted. They eliminated the "hot spot" caused by visible fixtures.[4]

Public education's objective is to develop to the fullest possible degree the individual child's capacities to the end that he may participate fully in our society. Public education is interested in spiritual, intellectual, and physical development. Cooperation, based on understanding, is the only way we can reach that objective.

Today schools are being built in a variety of plans, differing considerably one from another. There is a revolution in school architecture, but it is a thoughtful revolution. We are not all in agreement. Argument and discussion help bring out the best in method and material.

One architect developed and built a building which was functional. Inside, the classrooms were efficiently equipped and quite pleasant. Yet, because of the pressure for economy in both space and money, he felt that the school looked like a factory from the outside. It lacked warmth and beauty.

Capacity to pay is important, and architects recognize this fact. To economize and yet maintain high standards of architectural achievement, the architects have resorted to revolutionary methods.

Architects attempt to minimize traditional features that are nevertheless unproductive of useful space. Public pressure for tradition will sometimes prevent the best use of funds, however. In the case of one school, the community insisted on having a peaked roof over the monitor. The cost of the peaked roof was equivalent to six feet of space that could and should have been added to the cafeteria.

Mr. Lopez feels that we are behind in our building, but that maybe the curtailment of building during World War II was a good thing. At that time, educational theory had advanced well ahead of the school building. Now architects are more aware of educational theory and are better able to interpret the aims of education in terms of a more functional school building.

We must sell the conservative communities on the value of functional schools, and must let these people see children in these new buildings. We must convince special interest groups of the need.

Our new buildings are functional but not beautiful. One of the big problems is to make the building appear warm and inviting, to make it beautiful as well as functional. Where can the warmth and beauty be found? Some use color, others landscape, and still others use the outdoor classroom. To make our schools beautiful as well as functional is the next goal. It is a problem which can be solved.

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[4] See page 124 of the June, 1951, *Architectural Journal* for a drawing of this lighting system.

Bulletins in the Field of Education, Indiana University

The Bulletin of the School of Education, Indiana University, was first published in 1924 and has appeared regularly since that time. Research studies of interest to educators, proceedings of conferences held, and bibliographies of educational materials have been the principal fields touched upon in these bulletins. A complete list of the bulletins may be obtained from the School of Education upon request. The studies included in the present volume and in the two volumes immediately preceding it in date are listed below. Unless otherwise noted, these may be obtained for 75 cents each from the Indiana University Bookstore, Bloomington, Indiana.

Suggestions With Regard to Some Persistent Elementary School Problems. Vol. XXV, No. 1, 1949. 35 p. 50¢.

Public School Kindergartens in Indiana. By Phyllis Plichta. Vol. XXV, No. 2, 1949. 38 p.

Scores on the Interpretation of Data Test: Their Relationship to Measures of Achievement, Personality, and Interest. By Nicholas A. Fattu and William H. Fox. Vol. XXV, No. 3, 1949. 55 p.

Music in the Elementary Schools in Indiana. By Thurber H. Madison, Dorothy G. Kelley, and William H. Fox. Vol. XXV, No. 4, 1949. 64 p.

Indiana and Midwest School Building Planning Conference: Proceedings. Vol. XXV, No. 5, 1949. 72 p. $1.

A Study of a Secondary School Program in Light of Characteristics and Needs of Youth. By Wilson H. Ivins, William H. Fox, and David Segel. Vol. XXV, No. 6, 1949. 69 p.

Problems in School Administration. By Raleigh W. Holmstedt. Vol. XXVI, No. 1, 1950. 65 p.

Art in the Elementary Schools of Indiana. By Martha R. Carter and William H. Fox. Vol. XXVI, No. 2, 1950. 83 p.

Visual Environment for Schoolrooms (by Paul W. Seagers) *with Proceedings of the Indiana Illumination Conference.* Vol. XXVI, No. 3, 1950. 64 p.

Studies in Education: Abstracts of Theses, 1945-1949. Vol. XXVI, No. 4, 1950. 108 p.

Indiana and Midwest School Building Planning Conference: Proceedings. Vol. XXVI, No. 5, 1950. 75 p. $1.

An Examination of Enrollment and Budget Data for Indiana School Cities and Towns. By Maurice E. Stapley. Vol. XXVI, No. 6, 1950. 35 p.

Standardized Testing in the Schools of Indiana. By Roscoe A. Boyer and Merrill T. Eaton. Vol. XXVII, No. 1, 1951. 39 p.

Attitudes and Opinions of School Board Members in Indiana Cities and Towns. By Maurice E. Stapley. Vol. XXVII, No. 2, 1951. 42 p.

Some Characteristics of the Secondary School of the Future in the Light of Modern Developments. By Howard T. Batchelder and Shirley H. Engle. Vol. XXVII, No. 3, 1951. 34 p.

A Study of Some Opinions of High School Students With Regard to Teachers and Teaching. By Robert W. Richey and William H. Fox. Vol. XXVII, No. 4, 1951. 64 p.

Preprofessional Experiences in Educational Psychology: A Review of Opinion and a Critical Note. By Arthur P. Coladarci. Vol. XXVII, No. 5, 1951. 30 p.

Indiana and Midwest School Building Planning Conference: Proceedings. Vol. XXVII, No. 6, 1951. 139 p. $1.